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Aerospace Reports**

STAR

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Space Administration
Langley Research Center

**Scientific and Technical
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Scientific and Technical Aerospace Reports (STAR) is an electronic abstract journal, listing citations with abstracts for aerospace-related reports obtained from worldwide sources. It is electronically published biweekly and announces documents that have recently been entered into the NASA Scientific and Technical Information (STI) Database. The documents are of the following types:

- NASA, NASA contractor, and NASA grantee reports;
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- Translations in report form;
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses.

Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

Abstracts in *STAR* are categorized by 10 major subject divisions that are divided further into 76 specific subject categories. The subject divisions and categories are listed in the Table of Contents together with a note for each that defines its scope and provides any cross-references.

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Subject Divisions

Document citations are grouped first by the following divisions. Select a division title to view the category-level Table of Contents.

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G. Mathematical and Computer Sciences

H. Physics

I. Social and Information Sciences

J. Space Sciences

K. General

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for searching on *NASA Thesaurus* subject terms and personal author names.

Subject Term Index

Personal Author Index

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Subject Categories of the Division A. Aeronautics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 01 Aeronautics (General) 1**
Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics see *categories 02 through 09*. For information related to space vehicles see *12 Astronautics*.
- 02 Aerodynamics 1**
Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbo-machinery. For related information, see also *34 Fluid Mechanics and Heat Transfer*.
- 03 Air Transportation and Safety 2**
Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety*; and *85 Technology Utilization and Surface Transportation*.
- 04 Aircraft Communications and Navigation 7**
Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also *06 Avionics and Aircraft Instrumentation*; *17 Space Communications*; *Spacecraft Communications, Command and Tracking*, and *32 Communications and Radar*.
- 05 Aircraft Design, Testing and Performance 8**
Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Technology Utilization and Surface Transportation*.
- 07 Aircraft Propulsion and Power 13**
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.
- 08 Aircraft Stability and Control 16**
Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

09 Research and Support Facilities (Air) 17

Includes airports, runways, hangers, and aircraft repair and overhaul facilities, wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operation see *03 Air Transportation and Safety*. For astronomical facilities see *14 Ground Support Systems and Facilities (Space)*.

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

12 Astronautics (General) 18

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration, see *91 Lunar and Planetary Science and Exploration*.

15 Launch Vehicles and Launch Operations 20

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing, and Performance*; and *20 Spacecraft Propulsion and Power*.

18 Spacecraft Design, Testing and Performance 21

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see *54 Man/System Technology and Life Support*. For related information, see also *05 Aircraft Design, Testing and Performance*, *39 Structural Mechanics*, and *16 Space Transportation and Safety*.

20 Spacecraft Propulsion and Power 26

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also *07 Aircraft Propulsion and Power*; *28 Propellants and Fuels*; *15 Launch Vehicles and Launch Operations*; and *44 Energy Production and Conversion*.

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

23 Chemistry and Materials (General) 31

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics

in chemistry and materials see *categories 24 through 29*. For astrochemistry see category 90 *Astrophysics*.

- 24 Composite Materials 33**
Includes physical, chemical, and mechanical properties of laminates and other composite materials.
- 25 Inorganic, Organic, and Physical Chemistry 37**
Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 *Fluid Dynamics and Thermodynamics*, For astrochemistry see category 90 *Astrophysics*.
- 26 Metals and Metallic Materials 40**
Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.
- 27 Nonmetallic Materials 48**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 *Composite Materials*.
- 28 Propellants and Fuels 55**
Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 *Nuclear Physics*. For related information see also 07 *Aircraft Propulsion and Power*, 20 *Spacecraft Propulsion and Power*, and 44 *Energy Production and Conversion*.
- 29 Space Processing 58**
Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 *Law, Political Science and Space Policy*.

Subject Categories of the Division D. Engineering

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- 31 Engineering (General) 59**
Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.
- 32 Communications and Radar 61**
Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 *Aircraft Communications and Navigation*; and

17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see *03 Air Transportation and Safety*, and *16 Space Transportation and Safety*.

33 Electronics and Electrical Engineering 65

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

34 Fluid Mechanics and Thermodynamics 73

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

35 Instrumentation and Photography 92

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation*.

36 Lasers and Masers 94

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

37 Mechanical Engineering 96

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

38 Quality Assurance and Reliability 99

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

39 Structural Mechanics 100

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

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| 42 | Geosciences (General) | 103 |
| | Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see <i>categories 42 through 48</i> . | |
| 43 | Earth Resources and Remote Sensing | 108 |
| | Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see <i>35 Instrumentation and Photography</i> . | |
| 44 | Energy Production and Conversion | 112 |
| | Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see <i>73 Nuclear Physics</i> . For related information see also <i>07 Aircraft Propulsion and Power</i> ; <i>20 Spacecraft Propulsion and Power</i> , and <i>28 Propellants and Fuels</i> . | |
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| 47 | Meteorology and Climatology | 132 |
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Select a category to view the collection of records cited. N.A. means no abstracts in that category.

51 Life Sciences (General) 142

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

52 Aerospace Medicine 147

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

53 Behavioral Sciences 148

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 Man/System Technology and Life Support 149

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also *16 Space Transportation* and *52 Aerospace Medicine*.

55 Exobiology 152

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Science*.

Subject Categories of the Division G. Mathematical and Computer Sciences

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59 Mathematical and Computer Sciences (General) 153

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

60 Computer Operations and Hardware 153

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

- | | | |
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| | Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category. | |
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| | Includes computer networks and distributed processing systems. For information systems see <i>82 Documentation and Information Science</i> . For computer systems applied to specific applications, see the associated category. | |
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- 76 Solid-State Physics 196**
Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

Subject Categories of the Division I. Social and Information Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

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- ❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
- ❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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VOLUME 40, SEPTEMBER 20, 2002

01 AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20020070653 NASA Glenn Research Center, Cleveland, OH USA

Integrating Oil Debris and Vibration Gear Damage Detection Technologies Using Fuzzy Logic

Dempsey, Paula J., NASA Glenn Research Center, USA; Afjeh, Abdollah A., Toledo Univ., USA; July 2002; 21p; In English; 58th Annual Forum and Technology Display, 11-13 Jun. 2002, Montreal, Quebec, Canada; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): RTOP 728-30-10

Report No.(s): NASA/TM-2002-211126; NAS 1.15:211126; E-12976; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A diagnostic tool for detecting damage to spur gears was developed. Two different measurement technologies, wear debris analysis and vibration, were integrated into a health monitoring system for detecting surface fatigue pitting damage on gears. This integrated system showed improved detection and decision-making capabilities as compared to using individual measurement technologies. This diagnostic tool was developed and evaluated experimentally by collecting vibration and oil debris data from fatigue tests performed in the NASA Glenn Spur Gear Fatigue Test Rig. Experimental data were collected during experiments performed in this test rig with and without pitting. Results show combining the two measurement technologies improves the detection of pitting damage on spur gears.

Author

Damage; Detection; Fuzzy Systems; Oils; Systems Integration; Gears; Systems Health Monitoring; Vibration Tests

02 AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.

20020067681 Notre Dame Univ., Hestert Center for Aerospace Research, IN USA

Leading-Edge Receptivity to Vortical Disturbances

Corke, Thomas C., Notre Dame Univ., USA; Erturk, Ercan, Notre Dame Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 345-359; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The amplitude response of Klebanoff modes near the leading edge of a flat plate was studied for different amplitudes and scales of free-stream turbulence. The leading edge geometry consisted of 6:1 and 12:1 ellipses which were matched to a flat plate. The free-stream turbulence conditions were set using perforated grids and screens with different hole and mesh sizes. These were carefully selected so that combinations of turbulence intensities and scales could be independently changed. The freestream

turbulence conditions were documented for the grids and screens in terms of the total r.m.s, and spectra of streamwise velocity fluctuations. The turbulence conditions at the leading edge were changed by placing the plate at different streamwise distances from the grid or screen. The response of the boundary layer near the leading edge was then measured through wall-normal profiles of the mean and r.m.s. velocity fluctuations. The r.m.s. distributions and streamwise development agreed well with those associated with the Klebanoff mode. These were then used to determine an input-output response of the Klebanoff mode amplitude with the free-stream turbulence level. The results showed two regions: a 2:1 amplitude response for $u'/U(\text{sub infinity})$ less than or $= 0.5\%$ and a 4:1 response when $u'/U(\text{sub infinity})$ greater than 0.5% . In both cases, the response appeared to be linear.

Author

Leading Edges; Vortices; Disturbances; Free Flow

20020068079 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

Flight Motion of a Continuously Elastic Finned Missile *Final Report, Nov. 2000-Nov 2001*

Murphy, Charles H.; Mermagen, William H.; Jun. 2002; 64p; In English

Report No.(s): AD-A403876; ARL-TR-2754; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The motion of elastic finned projectiles has been analyzed by various approximate theories. In this report the exact equations of small amplitude motion are derived for a symmetric missile. The aerodynamic and elastic symmetries are used to allow the use of complex variables to describe the lateral motion in a non-rotating coordinate system. Although the resulting equations are both ordinary and partial differential equations, frequencies and damping rates of free oscillations are obtained from an ordinary differential equation with boundary conditions. Equations for a permanently deformed bent missile are derived, and an ordinary differential equation for the forced motion of a bent missile is obtained. Sample calculations for a finned projectile with a fineness ratio of 20 show resonant motion at the aerodynamic frequency as well as at each elastic frequency. The nonlinear roll moment associated with a bent missile is computed and the location of possible spin-yaw lock-in is determined. The flight motion of an elastic missile is shown to be the sum of two elliptical motions: a low frequency pitching motion and a higher frequency flexing motion. The induced drag coefficients for both motions are computed as functions of the missile's elasticity.

DTIC

Aerodynamic Characteristics; Flight Characteristics; Precision Guided Projectiles; Aerodynamic Configurations

20020068999 NASA Ames Research Center, Moffett Field, CA USA

Genetic Evolution of Shape-Altering Programs for Supersonic Aerodynamics

Kennelly, Robert A., Jr., NASA Ames Research Center, USA; Aug. 11, 2002; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Two constrained shape optimization problems relevant to aerodynamics are solved by genetic programming, in which a population of computer programs evolves automatically under pressure of fitness-driven reproduction and genetic crossover. Known optimal solutions are recovered using a small, naive set of elementary operations. Effectiveness is improved through use of automatically defined functions, especially when one of them is capable of a variable number of iterations, even though the test problems lack obvious exploitable regularities. An attempt at evolving new elementary operations was only partially successful.

Author

Shape Optimization; Computer Programming; Aerodynamics; Supersonic Flow; Functions (Mathematics)

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.

20020068072 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

Flow Stagnation as an Advanced Windblast Protection Technique *Final Report, Apr. 1982-Sep. 1985*

Specker, Lawrence J.; Jun. 2002; 9p; In English

Contract(s)/Grant(s): AF Proj. 7184

Report No.(s): AD-A403779; AFRL-HE-WP-TR-2002-0142; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A windblast protection device that uses high-strength, deployable fabric panels was tested. The panels capture and slow the aerodynamic flow impinging on the ejection seat occupant's extremities and torso and reduce the probability of injury caused by windblast. Wind tunnel tests were conducted in low- and high-speed wind tunnels using one-half scale models of a fiftieth-percentile size male crewmember and ejection seat. Measurements taken included forces and moments acting on the crewmember's arms, legs, and head; total forces and moments on the crewmember and seat model; and static pressure on the surface of the crewmember and flow-stagnation panels. Additional tests were accomplished to measure full-scale static aerodynamic coefficients of various flow-stagnation panels. These tests were accomplished with volunteer subjects and a modified ejection seat. This paper reviews the current tests accomplished using the flow-stagnation concept as well as tests utilizing the concept 25 and 45 years ago. Successful application of the flow-stagnation concept is a promising candidate solution to the problem of windblast protection.

DTIC

Wind Tunnel Tests; Aerodynamic Forces; Aerodynamic Characteristics; Aerodynamic Coefficients; Scale Models; Acceleration Tolerance

20020068135 NASA Ames Research Center, Moffett Field, CA USA

Re-Examination of Mixed Media Communication: The Impact of Voice, Data Link, and Mixed Air Traffic Control Environments on the Flight Deck

Dunbar, Melisa, San Jose State Univ., USA; McGann, Alison, San Jose State Univ., USA; Mackintosh, Margaret-Anne, San Jose State Univ., USA; Lozito, Sandra, NASA Ames Research Center, USA; July 2001; 32p; In English; Human Factors Conference, 2003, OH, USA

Contract(s)/Grant(s): NCC2-1095; DTFA01-X-0245; RTOP 711-41-12

Report No.(s): NASA/TM-2001-210919; IH-021; NAS 1.15:210919; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simulation in the B747-400 was conducted at NASA Ames Research Center that compared how crews handled voice and data link air traffic control (ATC) messages in a single medium versus a mixed voice and data link ATC environment. The interval between ATC messages was also varied to examine the influence of time pressure in voice, data link, and mixed ATC environments. For messages sent via voice, transaction times were lengthened in the mixed media environment for closely spaced messages. The type of environment did not affect data link times. However, messages times were lengthened in both single and mixed-modality environments under time pressure. Closely spaced messages also increased the number of requests for clarification for voice messages in the mixed environment and review menu use for data link messages. Results indicated that when time pressure is introduced, the mix of voice and data link does not necessarily capitalize on the advantages of both media. These findings emphasize the need to develop procedures for managing communication in mixed voice and data link environments.

Author

Communication Networks; Voice Communication; Data Links; Air Traffic Control

20020068898 NASA Ames Research Center, Moffett Field, CA USA

Crew Factors in Flight Operations XIV: Alertness Management in Regional Flight Operations Education Module

Rosekind, Mark R., Alertness Solutions, Inc., USA; Co, Elizabeth L., Alertness Solutions, Inc., USA; Neri, David F., Office of Naval Research, USA; Oyung, Raymond L., San Jose State Univ., USA; Mallis, Melissa M., NASA Ames Research Center, USA; February 2002; 134p; In English

Contract(s)/Grant(s): RTOP 548-30-32

Report No.(s): NASA/TM-2002-211393; NAS 1.15:211393; IH-027; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Regional operations encompass a broad range of pilots and equipment. This module is intended to help all those involved in regional aviation, including pilots, schedulers, dispatchers, maintenance technicians, policy makers, and others, to understand the physiological factors underlying fatigue, how flight operations affect fatigue, and what can be done to counteract fatigue and maximize alertness and performance in their operations. The overall purpose of this module is to promote aviation safety, performance, and productivity. It is intended to meet three specific objectives: (1) to explain the current state of knowledge about the physiological mechanisms underlying fatigue; (2) to demonstrate how this knowledge can be applied to improving flight crew sleep, performance, and alertness; and (3) to offer strategies for alertness management. Aviation Safety Reporting System (ASRS) and National Transportation Safety Board (NTSB) reports are used throughout this module to demonstrate that fatigue is a safety issue in the regional operations community. The appendices at the end of this module include the ASRS reports used for the

examples contained in this publication, brief introductions to sleep disorders and relaxation techniques, summaries of relevant NASA publications, and a list of general readings on sleep, sleep disorders, and circadian rhythms.

Author

Flight Crews; Flight Fatigue; Alertness; Sleep Deprivation; Sleep; Pilot Performance

20020068969 Veridian Engineering, Inc., Flight Research Group, Buffalo, NY USA

Airplane Upset Training Evaluation Report, Mar. 1999 - Nov. 2000

Gawron, Valerie J., Veridian Engineering, Inc., USA; May 2002; 578p; In English

Contract(s)/Grant(s): NAS2-99070; RTOP 728-20-30

Report No.(s): NASA/CR-2002-211405; NAS 1.26:211405; RPT-FLTR-8590-0001-Y00; No Copyright; Avail: CASI; A25, Hardcopy; A06, Microfiche

Airplane upset accidents are a leading factor in hull losses and fatalities. This study compared five types of airplane-upset training. Each group was composed of eight, non-military pilots flying in their probationary year for airlines operating in the USA. The first group, 'No aero / no upset,' was made up of pilots without any airplane upset training or aerobatic flight experience; the second group, 'Aero/no upset,' of pilots without any airplane-upset training but with aerobatic experience; the third group, 'No aero/upset,' of pilots who had received airplane-upset training in both ground school and in the simulator; the fourth group, 'Aero/upset,' received the same training as Group Three but in addition had aerobatic flight experience; and the fifth group, 'In-flight' received in-flight airplane upset training using an instrumented in-flight simulator. Recovery performance indicated that clearly training works - specifically, all 40 pilots recovered from the windshear upset. However few pilots were trained or understood the use of bank to change the direction of the lift vector to recover from nose high upsets. Further, very few thought of, or used differential thrust to recover from rudder or aileron induced roll upsets. In addition, recovery from icing-induced stalls was inadequate.

Author

Pilot Performance; Training Evaluation; Aerobatics; Pilot Training

20020068970 NASA Ames Research Center, Moffett Field, CA USA

Crew Factors in Flight Operations XV: Alertness Management in General Aviation Education Module

Rosekind, Mark R., Alertness Solutions, Inc., USA; Co, Elizabeth L., Alertness Solutions, Inc., USA; Neri, David F., Office of Naval Research, USA; Oyung, Raymond L., San Jose State Univ., USA; Mallis, Melissa M., NASA Ames Research Center, USA; February 2002; 152p; In English

Contract(s)/Grant(s): RTOP 548-30-32

Report No.(s): NASA/TM-2002-211394; NAS 1.15:211394; IH-028; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Regional operations encompass a broad range of pilots and equipment. This module is intended to help all those involved in regional aviation, including pilots, schedulers, dispatchers, maintenance technicians, policy makers, and others, to understand the physiological factors underlying fatigue, how flight operations affect fatigue, and what can be done to counteract fatigue and maximize alertness and performance in their operations. The overall purpose of this module is to promote aviation safety, performance, and productivity. It is intended to meet three specific objectives: (1) to explain the current state of knowledge about the physiological mechanisms underlying fatigue; (2) to demonstrate how this knowledge can be applied to improving flight crew sleep, performance, and alertness; and (3) to offer strategies for alertness management. Aviation Safety Reporting System (ASRS) and National Transportation Safety Board (NISH) reports are used throughout this module to demonstrate that fatigue is a safety issue in the regional operations community. The appendices at the end of this module include the ASRS reports used for the examples contained in this publication, brief introductions to sleep disorders and relaxation techniques, summaries of relevant NASA publications, and a list of general readings on sleep, sleep disorders, and circadian rhythms.

Author

Flight Crews; Flight Operations; Flight Safety; Flight Fatigue; Alertness; Sleep Deprivation; Safety Management

20020069008 NASA Ames Research Center, Moffett Field, CA USA

Wake-Vortex Hazards During Cruise

Rossow, Vernon J., NASA Ames Research Center, USA; James, Kevin D., NASA Ames Research Center, USA; Sep. 30, 1998; 18p; In English; AIAA 17th Applied Aerodynamics Conference, 28 Jun. - 1 Jul., Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 522-11-52; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Even though the hazard posed by lift-generated wakes of subsonic transport aircraft has been studied extensively for approach and departure at airports, only a small amount of effort has gone into the potential hazard at cruise altitude. This paper reports on a study of the wake-vortex hazard during cruise because encounters may become more prevalent when free-flight becomes available and each aircraft, is free to choose its own route between destinations. In order to address the problem, the various fluid-dynamic stages that vortex wakes usually go through as they age will be described along with estimates of the potential hazard that each stage poses. It appears that a rolling-moment hazard can be just as severe at cruise as for approach at airports, but it only persists for several minutes. However, the hazard posed by the downwash in the wake due to the lift on the generator aircraft persists for tens of minutes in a long narrow region behind the generating aircraft. The hazard consists of severe vertical loads when an encountering aircraft crosses the wake. A technique for avoiding vortex wakes at cruise altitude will be described. To date the hazard posed by lift-generated vortex wakes and their persistence at cruise altitudes has been identified and subdivided into several tasks. Analyses of the loads to be encountered are underway and should be completed shortly. A review of published literature on the subject has been nearly completed (see text) and photographs of vortex wakes at cruise altitudes have been taken and the various stages of decay have been identified. It remains to study and sort the photographs for those that best illustrate the various stages of decay after they are shed by subsonic transport aircraft at cruise altitudes. The present status of the analysis and the paper are described.

Author

Aircraft Wakes; Free Flight; Hazards; Vortices; Transport Aircraft

20020069083 Morgan State Univ., National Transportation Center, Baltimore, MD USA

BWI Terminal Accessibility Study

Reed, R.; Dec. 2001; 98p; In English

Report No.(s): PB2002-104694; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This study details the landside accessibility of the BWI airport. The accessibility of the airport is examined from each of the access facilities. Included in the study are the terminal garage, ESP parking lot, all satellite lots and terminal curbside drop-offs. The study confirms much of what most informed people 'know' about landside access of the airport, but does contain some information that is surprising. The garage provides the most rapid average access followed by the ESP lot. The satellite lots provide the highest average access times. Terminal curbside drop-off is studied separately and displays a very high variance. The use of the lower roadway for morning rush hour shuttle delivery of passengers drastically reduces access times for the lots affected. This practice yields results that are quantified as well. The congestion of the upper level roadway provides a major drag on access and this is quantified for the various lots during different periods of day and days of week. In addition, forecasting techniques are used to determine what average access times might be after an increase in passenger usage of access facilities. These forecasts show that, given no changes in other conditions, all access facilities could face unacceptable access times with as little as a 25-50% increase in passenger use of the access facilities.

NTIS

Airports; Forecasting; Passengers

20020069088 National Aerospace Lab., Amsterdam Netherlands

Accident Risk Assessment for Advanced ATM

Blom, H. A. P.; Bakker, G. J.; Blanker, P. J. G.; Daams, J.; Everdij, M. H. C.; Jan. 1999; 34p; In English

Report No.(s): PB2002-105867; NLR-TP-99015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By now, safety is recognised as a key quality on which to select/design advanced ATM concepts, even when capacity and efficiency are the drivers of the development. The safety target is often described as equal or better in comparison with existing practice, allowing a large freedom in how safety is expressed, let alone measured. In effect, new CNS/ATM concept developments are typically accomplished without the use of feedback from appropriate safety assessments. ATM concept design teams (e.g. of Free Flight, or 4D-ATM) try to realise capacity-efficiency enhancements by exploiting new technology, changing human controller roles and introducing new procedures, while relying on the established safety-related indicators in ATM such as conflict rates and types, workload of human operators and failure rates and effects of technical systems. ATM, however, is the result of complex interactions between multiple human operators, procedures and technical systems, all highly distributed. This yields that providing safety is more than making sure that each of the ATM elements functions properly safe; it is the complex interaction between them that determines safety. The assessment of isolated indicators falls short in covering the complex interactions between procedures, human operators and technical systems in safety-critical non-nominal situations. In order to improve this situation, this paper outlines a novel probabilistic risk assessment methodology which has specifically been developed for application to ATM. In addition, this paper presents risk assessment results which have been obtained with this approach for two

en-route streams of RNP1 equipped traffic flying in opposite direction within two conventional ATM concepts and two airborne separation assurance based concepts. These results illustrate that our new methodology supports safety-based ATM design.

NTIS

Air Traffic Control; Risk; Aircraft Accidents; Assessments; Feedback; Manual Control; Safety

20020070662 Research Triangle Inst., Research Triangle Park, NC USA

Characterizing the Severe Turbulence Environments Associated With Commercial Aviation Accidents, Part 1, 44 Case Study Synoptic Observational Analyses

Kaplan, Michael L., North Carolina State Univ., USA; Huffman, Allan W., North Carolina State Univ., USA; Lux, Kevin M., North Carolina State Univ., USA; Charney, Joseph J., North Central Research Station, USA; Riordan, Allan J., North Carolina State Univ., USA; Lin, Yuh-Lang, North Carolina State Univ., USA; August 2002; 57p; In English

Contract(s)/Grant(s): NAS1-99074; 82U-7473-008; RTOP 728-40-30-01

Report No.(s): NASA/CR-2002-211918/PT1; NAS 1.26:211918/PT1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A 44 case study analysis of the large-scale atmospheric structure associated with development of accident-producing aircraft turbulence is described. Categorization is a function of the accident location, altitude, time of year, time of day, and the turbulence category, which classifies disturbances. National Centers for Environmental Prediction Reanalyses data sets and satellite imagery are employed to diagnose synoptic scale predictor fields associated with the large-scale environment preceding severe turbulence. These analyses indicate a predominance of severe accident-producing turbulence within the entrance region of a jet stream at the synoptic scale. Typically, a flow curvature region is just upstream within the jet entrance region, convection is within 100 km of the accident, vertical motion is upward, absolute vorticity is low, vertical wind shear is increasing, and horizontal cold advection is substantial. The most consistent predictor is upstream flow curvature and nearby convection is the second most frequent predictor.

Author

Turbulence Effects; Aircraft Accidents; Aircraft Stability; Curvature; Vorticity

20020070669 University of Southern California, Dept. of Industrial and Systems Engineering, Los Angeles, CA USA

Alternative Access and Locations for Air Cargo

Jun. 13, 2002; 50p; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-108189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, air cargo has been the fastest growing segment of the goods movement industry in the USA, placing increasing demands both on airports and ground transportation to/from airports. This project documents and analyzes issues confronting air cargo movements in Southern California (the Los Angeles and San Diego areas), develops strategies for accommodating growth in air cargo, and assesses the impacts of these strategies on carrier operations. The emphasis is on the operation of the cargo carriers themselves, rather than on the governmental entities that serve these carriers. Particular emphasis is given to operation of integrated carriers. Within Southern California, LAX is the dominant cargo airport, trailed by Ontario and San Diego. LAX acts as an international gateway between North America and Asia. It is also the location for the FedEx 'Metroplex' (min-hub). The majority of the freight traffic through LAX travels on passenger/freight airlines. Ontario is dominated by UPS' regional hub, which serves 78% of the airport's freight volume. San Diego provides a mixture of domestic and international service. Other airports serve domestic hub traffic of integrated airlines, within local areas. This report describes the roles of these airports with respect to the operational concerns of air cargo carriers.

NTIS

Air Cargo; Airline Operations; Civil Aviation; Commercial Aircraft

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.

20020067708 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Contributions to the AIAA Guidance, Navigation and Control Conference

Campbell, S. D., Editor; Jan. 23, 2002; 88p; In English; AIAA Guidance, Navigation and Control Conference, 6-9 Aug. 2001, Montreal, Canada

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): PB2002-104359; NASA/A-5; No Copyright; Avail: National Technical Information Service (NTIS)

This report contains six papers presented by the Lincoln Laboratory Air Traffic Control Systems Group at the American Institute of Aeronautics & Astronautics (AIAA) Guidance, Navigation and Control (GNC) conference on 6-9 August 2001 in Montreal, Canada. The work reported was sponsored by the NASA Advanced Air Transportation Technologies (AATT) program and the FAA Free Flight Phase 1 (FFP1) program. The papers are based on studies completed at Lincoln Laboratory in collaboration with staff at NASA Ames Research Center. These papers were presented in the Air Traffic Automation Session of the conference and fall into three major areas: Traffic Analysis & Benefits Studies, Weather/Automation Integration and Surface Surveillance. In the first area, a paper by Andrews & Robinson presents an analysis of the efficiency of runway operations at Dallas/Ft. Worth using a tool called PARO, and a paper by Welch, Andrews & Robinson presents a delay benefit results for the Final Approach Spacing Tool (FAST). In the second area, a paper by Campbell, et al describes a new weather distribution systems for the Center/TRACON Automation System (CTAS) that allows ingestion of multiple weather sources, and a paper by Vandevenne, Lloyd & Hogaboom describes the use of the NOAA Eta model as a backup wind data source for CTAS. Also in this area, a paper by Murphy & Campbell presents initial steps towards integrating weather impacted routes into FAST. In the third area, a paper by Welch, Bussolari and Atkins presents an initial operational concept for using surface surveillance to reduce taxi delays.

NTIS

Air Traffic Control; Automatic Control; Conferences; Navigation; Aeronautics; Air Transportation; Avionics

20020068095 Missouri Univ., Dept. of Physics and Astronomy, Columbia, MO USA

Inverse Problem Research to Improve the Global Positioning System Final Report, Mar. 1999-30 May 2002

DeFacio, Brian; Jun. 20, 2002; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0178

Report No.(s): AD-A404122; AFRL-SR-AR-TR-02-0217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Final Report of a three year (plus no-cost extension) research grant to study GPS. Techniques used were developed on earlier AFOSR/NM grants, and include inverse problems, wavelets, information theory, and geodesy. This project developed new signal processing methods, either: (1) to improve the accuracy of the GPS, (2) to generalize GPS to other planets and moons in our solar system or even beyond, or (3) to detect and defeat tampering with the security of the GPS. Jamming, spoofing and unwanted access can come from human sources or atmospheric conditions. The multipath reduction paper discusses topics (1) and (3), while the Feynman functional and geodesy papers discuss all the topics above, (1)-(3). The gravity detection work in progress gives markers to detect tampering with GPS, as well as being very important to fundamental physics and geophysics.

DTIC

Global Positioning System; Functions (Mathematics)

20020069103 National Aerospace Lab., Amsterdam Netherlands

Development of a Position Reference System for Flight Tests Based on GPS

Kannemans, H.; van Leeuwen, S. S.; Jun. 1999; 34p; In English

Report No.(s): PB2002-105876; NLR-TP-97483; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At the National Aerospace Laboratory of the Netherlands (NLR) a Position Reference System for in-flight accurate position measurements based on GPS has been developed and validated. The system uses Differential GPS positions to correct the aircraft trajectory as delivered by an Inertial Reference System. Depending on the application, a medium accuracy (+ 5 m), an enhanced accuracy (+ 0.6 m) or a high accuracy (+ 0.15 m) update mode can be selected. The medium- and enhanced accuracy modes are available in both real-time and after the flight, the high accuracy mode is only available after the flight. In the paper the requirements for the Position Reference System will be given. The system hardware and software will be described. Until now

the system has been used during a number of flight test programmes with Fokker prototype aircraft. A two month period of one of these programmes was selected, flight test data from this period were processed in each of the above mentioned update modes. The results will be shown and discussed.

NTIS

Flight Tests; Global Positioning System; Navigation Aids; Inertial Reference Systems

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.

20020067713 Physics and Electronics Lab. TNO, The Hague, Netherlands

Familybuilding Simulators Royal Netherlands Army: Partial Report on Developments At National and International Levels Final Report Familievorming Simulators KL Deelrapport Ontwikkelingen in Binnen- En Buitenland

Langeslag, P. J. H., Physics and Electronics Lab. TNO, Netherlands; Gouweleeuw, R. G. W., Physics and Electronics Lab. TNO, Netherlands; Fiebelkorn, S., Physics and Electronics Lab. TNO, Netherlands; April 2002; 112p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A01/KL/655; TNO Proj. 015.31191

Report No.(s): TD01-0307; FEL-02-B112; Copyright; Avail: Issuing Activity

One of the objectives of the Modelling and Simulation policy of the Royal Netherlands Army is to optimize the use of advanced training devices through standardization and the creation of a family of simulators. This document reports on the results of a study into present and future technologies that are relevant for creating a family of simulators. In this study the various components of a training simulator are considered separately: instruction facilities, computer generated forces etc. For every component the current level of technology is described and the expected future developments are discussed. Based on this research the opportunities for creating a family of simulators with these technologies are singled out and recommendations were formulated for future acquisitions of simulators. In these recommendations the following issues were identified: Standard user interface; Modularity of the system concept; Use of the same application for comparable functions; Interoperability with other simulators; Standard terrain database; Standard format for 3D (three dimensional) models; Standard hardware if possible. In the continuation of this project these recommendations shall be worked out in directives for the acquisition process of future training simulators.

Author

Training Simulators; Standardization; Computerized Simulation; Human-Computer Interface; Armed Forces (Foreign)

20020067720 Army Command and General Staff Coll., School of Advanced Military Studies, Fort Leavenworth, KS USA

The Quality of Quantity: Mini-UAVS As An Alternative UAV Acquisition Strategy at the Army Brigade Level

Weed, Shawn C.; May 24, 2002; 67p; In English; Original contains color images

Report No.(s): AD-A403846; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This monograph asks should the U.S. Army alter its current UAV acquisition strategy for maneuver brigades from one in which limited numbers of high capability systems are acquired, in favor of another that fields a large quantity of less capable mini-UAVs? As a system, the sheer quantity of deployed collection assets, inherent design austerity, and flexible organization give them a significant advantage in fulfilling the requirements of a brigade level UAV system than their more conventional UAV cousins. to support this conclusion, this monograph will analyze the strengths and weaknesses of both the current UAV acquisition plan and a proposed mini-UAV strategy, compare the two systems in relation to the design parameters established for a brigade level UAV, then marry the results of this assessment to action in the form of a recommended alternative mini-UAV acquisition strategy.

DTIC

Aircraft Design; Design Analysis; Dast Program

20020068006 Virginia Polytechnic Inst. and State Univ., Aerospace and Ocean Engineering Dept., Blacksburg, VA USA
Analysis for the Progressive Failure Response of Textile Composite Fuselage Frames *Final Report, 10 Jun. 2001 - 31 Jul. 2002*

Johnson, Eric R., Virginia Polytechnic Inst. and State Univ., USA; Jul. 31, 2002; 9p; In English
Contract(s)/Grant(s): NAG1-01123; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A part of aviation accident mitigation is a crashworthy airframe structure, and an important measure of merit for a crashworthy structure is the amount of kinetic energy that can be absorbed in the crush of the structure. Prediction of the energy absorbed from finite element analyses requires modeling the progressive failure sequence. Progressive failure modes may include material degradation, fracture and crack growth, and buckling and collapse. The design of crashworthy airframe components will benefit from progressive failure analyses that have been validated by tests. The subject of this research is the development of a progressive failure analysis for a textile composite, circumferential fuselage frame subjected to a quasi-static, crash-type load. The test data for the frame are reported, and these data are used to develop and to validate methods for the progressive failure response.

Author

Textiles; Composite Materials; Failure Analysis; Fuselages; Aircraft Construction Materials

20020068025 Marine Corps Systems Command, Quantico, VA USA
Strategic and Operational Relevance of Heavy Lift in the USA Marine Corps: CH-53E Program

McLellan, Archibald M.; Jul. 2002; 65p; In English; Original contains color images
Report No.(s): AD-A404092; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This essay examines the strategic and operational relevance of the heavy lift capability in the USA Marine Corps. The only way to truly realize the full potential of Expeditionary Maneuver Warfare (EMW) and the capabilities of the MV-22, is to maintain the existing synergistic relationship between the medium and heavy lift aircraft working together to accomplish the mission. In current future plans the MV-22 will be required to carry external loads for 48 percent of its sorties in the movement of a Regimental Landing Team (RLT). This minimizes the speed advantage of the MV-22, as the limitations inherent with external loads (increased drag, load instability and integrity), prevent taking most external loads out toward the maximum speed of the MV-22. Accordingly, the best alternative to ensuring that we preserve the MV-22 speed advantage is to ensure there are adequate numbers of CH-53E helicopters to perform all the majority of external lift missions. If the Marine Corps changed the current ratio of medium lift to heavy lift aircraft from 3:1 to 2:1 i.e., by adding two CH-53E's to the current MEU, increasing the number of CH-53E's (to six) we would see a 20 percent reduction in total waves and a 22 percent decrease in time required to accomplish a reinforced Company movement. In the future changing the force ratio from 2:1 to 1:1 (medium to heavy), the CH-53E (SLEP) has the potential to provide a significant improvement in the ability to move the force. There is the potential for a 28 percent decrease in sorties required to accomplish a Regimental Landing Team movement by air and an overall timesaving of 29 percent in addition to the already realized savings of 25 percent from balancing the force with today's CH-53E.

DTIC

Helicopters; Military Operations

20020068027 Marine Corps Systems Command, Quantico, VA USA
The History of Heavy Lift: Can the 1947 Vision of an All Heavy Helicopter Force Achieve Fruition in 2002?

Barich, James D.; Jan. 2002; 48p; In English
Report No.(s): AD-A403884; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Seeking alternatives to the World War II amphibious landing, the Commandant tasked his amphibious commanders to, 'Compose a special board to propose ... concepts and principles ... to wage successful amphibious warfare in the future'. The Board recommended the Vertical Assault Doctrine, which rested on the development of the HR2S-1 a heavy lift helicopter able to carry 20 Marines. However, design and production problems forced the Marine Corps to replace it with a medium lift helicopter called the HUS-1. The demise of heavy lift as the backbone of the Vertical Assault Doctrine began with the fact that the technology of a heavy lift helicopter was not feasible until 1955, by which time the Marine Corps had reoriented to become a medium lift force. The Marine Corps did eventually develop the CH-53E heavy lift helicopter; however, never with the intention of replacing the medium lift force. In an ironic twist of fate the medium lift replacement MV-22 has encountered long delays in testing and production reminiscent of the HR2S-1. Hence, the CH-53E has filled the major role as an interim helicopter in the Doctrine of Operational Maneuver from the Sea (OMFTS).

DTIC

Amphibious Aircraft; Heavy Lift Helicopters; Aircraft Design

20020068063 Marine Corps Development and Education Command, Quantico, VA USA

The Song Remains the Same: USA Marine Corps and V/STOL, Dec. 2001 - Dec. 2002

Coolican, Michael A.; Jan. 2002; 51p; In English

Report No.(s): AD-A403750; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The USMC desired a fixed-wing VSTOL aircraft since the 1950's for two reasons; basing flexibility and Close Air Support responsiveness, while those two reasons have remained constant, various explanations for those reasons have arisen and changed throughout the years.

DTIC

Aircraft Configurations; V/STOL Aircraft; Armed Forces (USA)

20020068085 Secretary of the Air Force, Washington, DC USA

Air Force Handbook 63-1402. Aircraft Information Program

Mar. 19, 2001; 57p; In English

Report No.(s): AD-A404043; AFH-63-1402; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Aircraft Information Program (AIP) supports mishap investigations, Flight Operational Quality Assurance (FOQA), Reliability Centered Maintenance (RCM), Aircraft and Engine Structural Integrity Programs (ASIP/ENSIP), aircraft development programs and training. Its primary goal is to balance information needs with program resources and operational considerations. This handbook provides guidance in selecting the appropriate recording parameters and functional requirements for information collection systems. Mishap investigations are relatively straightforward processes where causes and contributing factors are determined and used to produce a list of recommendations that should prevent future mishaps. However, many investigations are inconclusive due to lack of evidence to support mishap scenarios. This allows insidious conditions to persist and cause future mishaps.

DTIC

Information Systems; Rotary Wing Aircraft; Aircraft Design; Aircraft Engines; Functional Design Specifications

20020068086 Marine Corps Schools, Command and Staff Coll., Quantico, VA USA

The KC-130 and Expeditionary Operations

Cote, Robert P.; Jan. 2002; 49p; In English

Report No.(s): AD-A404040; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The KC-130 is an important force multiplier for the Marine Air Ground Task Force (MAGTF) Following Operation Desert Storm the Hercules has been increasingly employed in an expeditionary environment. These missions, flown with airframes nearing the end of their service life, have highlighted deficiencies within the KC-130 inventory. Complicating matters is enlisted aircrew manning shortages, conflicting viewpoints on KC-130 employment, and conflicting mission priorities. The KC-130J will alleviate many of the current problems, but it will be years before it is fully integrated into the fleet. The increased demand for KC-130 support, particularly as an aerial refueler, will continue to highlight these problem areas. In order for the KC-130 to be successfully utilized within an expeditionary environment, proper equipment, training, and resources must be implemented.

DTIC

Transport Aircraft; C-130 Aircraft; Military Technology; Air to Air Refueling

20020068132 Terry Engineering, Andover, KS USA

Design and Test of an Improved Crashworthiness Small Composite Airframe

Terry, James E., Terry Engineering, USA; Hooper, Steven J., Wichita State Univ., USA; Nicholson, Mark, Wichita State Univ., USA; August 2002; 228p; In English

Contract(s)/Grant(s): NAS1-20427; RTOP 728-50-10-01

Report No.(s): NASA/CR-2002-211774; NAS 1.26:211774; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The purpose of this small business innovative research (SBIR) program was to evaluate the feasibility of developing small composite airplanes with improved crashworthiness. A combination of analysis and half scale component tests were used to develop an energy absorbing airframe. Four full scale crash tests were conducted at the NASA Impact Dynamics Research Facility, two on a hard surface and two onto soft soil, replicating earlier NASA tests of production general aviation airplanes. Several seat designs and restraint systems including both an air bag and load limiting shoulder harnesses were tested. Tests showed that occupant loads were within survivable limits with the improved structural design and the proper combination of seats and restraint systems. There was no loss of cabin volume during the events. The analysis method developed provided design guidance but time

did not allow extending the analysis to soft soil impact. This project demonstrated that survivability improvements are possible with modest weight penalties. The design methods can be readily applied by airplane designers using the examples in this report.

Author

Airframes; Structural Design; Crashworthiness; Full Scale Tests; General Aviation Aircraft; Safety Devices; Composite Materials

20020068714 Marine Corps Development and Education Command, Quantico, VA USA

Amphibious Search and Rescue: Shaping the Future

Dowling, Michael G.; Jan. 2002; 50p; In English; Original contains color images

Report No.(s): AD-A403969; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current Amphibious Search and Rescue (ASAR) mission is outdated, lacks integration with the mission/doctrine of the amphibious force and fails to exploit the multi-mission and tactical capabilities of the MH-60S helicopter. The Navy and the Marine Corps must recognize and integrate the capabilities of the MH-60S with the vision and doctrine of the amphibious forces in order to define the ASAR mission, then develop procedures to perform the stated mission requirements. The mission of Navy helicopters in the ATF has developed in piecemeal fashion; based solely on the capabilities of the HH-46D helicopter and not integrated with the mission requirements of the ATF and MEU. As a result, ASAR detachments have limited capabilities for critical missions in the ATF, including NSW, TRAP, and AT/FP. The MH-60S, the replacement helicopter for the aging HH-46D, is a tactical platform with capabilities for the following missions: Maritime Dominance, Logistics, CSAR, NSW, and AMCM missions. The Navy helicopter community must look forward to determine if the current mission will remain viable in the near future. Implement a four-helicopter detachment into the ATF and expand the ASAR mission to include AMCM, overwater TRAP, NSW, and 'Limited' ASUW, AT/FP and SSC roles. Two of the four helicopters would be specifically outfitted for AMCM missions.

DTIC

Helicopters; Rescue Operations; Amphibious Vehicles

20020068903 Northrop Grumman Corp., Baltimore, MD USA

Program Management Process on F/A-18E/F--New Directions

Odum, Richard F.; Carrier, L.; Babich, N.; Hunt, B.; LePoint, R.; Shedd, J.; Jun. 2002; 8p; In English; X Dec 2002 to x Dec 2002 Proceedings of the 29th Annual Project Management Institute 1998 Seminars & Symposium Long Beach, California, USA: Papers Presented October 9 to 15, 1998

Report No.(s): AD-A403906; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The benefits of this approach can be determined by the results. All of our E/F major milestones were achieved on or ahead of schedule. All of our aircraft deliveries were made on or ahead of schedule. All aircraft specification requirements are being met. Our Cum CPI (cost performance index) and SPI (schedule performance index) on the EMD (engineering and manufacturing development) program and on the LRIP (low rate initial production) program is praise-worthy. The change rate on the F/A-18E/F was one-third of the change rate on F/A-18A/B. The number of defects in manufacturing the E/F during EMD was significantly lower than A/B. We have achieved a 60 percent reduction in the manufacturing defects on the F/A-18C/D since 1995. The E/F program received the DoD (Department of Defense) Acquisition in Excellence Award, the AIAA (American Institute of Aeronautics and Astronautics) Aircraft Design Award, and the Vision Award for excellence in business performance reporting and has set a high watermark for being a near-model acquisition program. This approach has resulted in outstanding award fees on the EMD contract and the NAVICP (Naval Inventory Control Point) Blue Star Award for spares performance on the C/D program. Additionally, we have become a Silver Level Preferred Supplier to Boeing and have become ISO 9001 qualified by our local DCMC (Defense Contract Management Command),

DTIC

Management Information Systems; Fighter Aircraft

20020069075 National Aerospace Lab., Space Div., Amsterdam, Netherlands

Information and Communication Technology for Industrial Design Using Parallel CFD

Vogels, M. E. S.; Jun. 1999; In English

Report No.(s): PB2002-105869; NLR-TP-99227; No Copyright; Avail: National Technical Information Service (NTIS)

The awareness of the role of Computational Fluid Dynamics (CFD) in the entire aircraft development process in industry has shifted the Information and Communication Technology (ICT) focus from 'parallelising the compute intensive element in CFD analysis' to a wider view. The wider view includes 1. speeding up the entire CFD analysis, and not just the compute intensive part 2. performing trade-off studies across disciplines and 3. managing the industry's competence including the industry's competence

on parallel CFD. Based on various projects on Dutch and European scales, different aspects from the contribution of Information and Communication Technology are highlighted.

NTIS

Computational Fluid Dynamics; Aircraft Configurations; Aerospace Industry; Information Systems; Parallel Processing (Computers)

20020069076 National Aerospace Lab., Amsterdam Netherlands

Information and Communication Technology's Contribution to the MDO Project

Vogels, M. E. S.; Allwright, S. E.; Stettner, M.; Bartholomew, P.; Mar. 1999; 20p; In English

Report No.(s): PB2002-105868; NLR-TP-99029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When an enterprise embarks on an initiative to exploit multi-discipline analysis, design, and optimisation (MDO), the enterprise faces, next to the aeronautical challenge, challenges with respect to Information and Communication Technology to support the aeronautics work. Experiences in the Brite-Euram MDO project, executed by 14 European aeronautics companies, institutes, and universities, have led to the identification of three key ICT areas. Firstly, the process followed by the MDO team, being evolutionary by nature, requires the MDO process to be documented and, of course, communicated in a manner understandable and accessible for the MDO team. MDO results can only be interpreted in relation to the process in which they were generated. Secondly, the specialists from the various disciplines need to work on the same design, and within the same timeframe, to bring together their result to come to a next design. This requires the path from the a/c specification to analysis, design, and optimisation models to be automated. Finally, the information, tools and the operation of the enterprises computer network have to be arranged to form an effective and friendly environment for the MDO team to operate within. In the paper, highlights of the MDO project in the three key ICT areas are presented.

NTIS

Computer Networks; Information Systems; Communication Networks; Multidisciplinary Design Optimization; Aerospace Engineering

20020070601 State Univ. of New York, Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY USA

Vibration Reduction of Helicopter Blade Using Variable Dampers: A Feasibility Study

Lee, George C., State Univ. of New York, USA; Liang, Zach, State Univ. of New York, USA; Gan, Quan, State Univ. of New York, USA; Niu, Tiecheng, State Univ. of New York, USA; August 2002; 68p; In English

Contract(s)/Grant(s): NAG2-1429; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the report, the investigation of controlling helicopter-blade lead-lag vibration is described. Current practice of adding passive damping may be improved to handle large dynamic range of the blade with several peaks of vibration resonance. To minimize extra-large damping forces that may damage the control system of blade, passive dampers should have relatively small damping coefficients, which in turn limit the effectiveness. By providing variable damping, a much larger damping coefficient to suppress the vibration can be realized. If the damping force reaches the maximum allowed threshold, the damper will be automatically switched into the mode with smaller damping coefficient to maintain near-constant damping force. Furthermore, the proposed control system will also have a fail-safe feature to guarantee the basic performance of a typical passive damper. The proposed control strategy to avoid resonant regions in the frequency domain is to generate variable damping force in combination with the supporting stiffness to manipulate the restoring force and conservative energy of the controlled blade system. Two control algorithms are developed and verified by a prototype variable damper, a digital controller and corresponding algorithms. Primary experiments show good potentials for the proposed variable damper: about 66% and 82% reductions in displacement at 1/3 length and the root of the blade respectively.

Author

Helicopters; Rotors; Vibration Damping; Algorithms

20020070678 Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

Review of Aeronautical Fatigue Investigations in Sweden during the Period June 1999 to May 2001. Presented at the 27th Conference of the International Committee on Aeronautical Fatigue, Toulouse, France on 25-26 June 2001

Blom, A. F.; Palmberg, B.; Jun. 2001; 81p; In English

Report No.(s): PB2002-105013; FOI-R-0138-SE; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The document is prepared for presentation at the 27th Conference of the International Committee on Aeronautical Fatigue, scheduled to be held in Toulouse, France, 25-26 June 2001. A review is given on the work carried out in Sweden in the area of Aeronautical fatigue during the period from June 1999 to May 2001. The review includes aircraft loading actions, basic studies

of fatigue development in metals and composites, stress analysis, and fracture mechanics, studies of crack propagation and residual strength, testing of joints and full-scale structures, and fatigue life predictions.

NTIS

Fatigue (Materials); Aeronautical Engineering; Residual Strength

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

20020067663 Cambridge Univ., Whittle Lab., Cambridge, UK

High Lift Low Pressure Turbines

Hodson, H. P., Cambridge Univ., UK; Howell, R. J., Cambridge Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 37-78; In English; Also announced as 20020067662; The conference proceeding is available in hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In aircraft engines, chord-based Reynolds numbers of the order of $0.5 - 5 \times 10^5$ are found in the low pressure turbines. Given that many component efficiencies are above 90 percent, improving the efficiency has become progressively more difficult. Consequently, a reduction in component count is now a common goal. Reducing the number of airfoils in a turbine inevitably leads to an increase in the blade loading. This increases the possibility of laminar separation in these low Reynolds number flows. Conventional (steady flow) wisdom dictates that the efficiency decreases as the laminar separation bubble grows. This perception has limited the development of low pressure turbines for many years. In practice, the flow in turbomachines is unsteady due to the relative motion of the rows of blades. The combined effects of random (wake turbulence) and periodic disturbances (wake velocity defect and pressure fields) will affect the transition processes in low Reynolds number turbomachines. Research has shown that patches of transitional/turbulent flow can be created during the interaction of the upstream wakes with laminar boundary layers. These patches will reduce the efficiency. Fortunately, the so-called calmed regions, where the flow relaxes back to the laminar state, that follow the transitional/turbulent flow can withstand the deceleration much better than steady flow laminar boundary layers. Consequently, in high lift applications, attached laminar-like flow can be made to persist downstream of the steady flow laminar separation line, possibly as far back as the trailing edge. Most importantly, the calmed region represents an increase in efficiency as it is essentially laminar in nature and it is attached. Thus, there are two opposing mechanisms at work in the interactions between wakes and the boundary layers. As the frequency of wake-passing changes, so does the balance between these mechanisms. This presentation will describe progress in understanding the details of the flow and the loss generation processes that arise in LP turbines. Particular emphasis will be placed on the unsteady separating flows, and how their effects may be exploited in controlling the laminar-turbulent transition processes that has allowed the successful development of ultra high lift low pressure turbines.

Author

Low Pressure; Turbines; Boundary Layer Separation; Flow Velocity; Pressure Distribution; Wakes; Lift

20020067664 Honeywell Engines and Systems, Phoenix, AZ USA

Low Pressure Turbine Reynolds Number Effects: Small Engine Perspective

Heitland, Greg, Honeywell Engines and Systems, USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 79-91; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The research work on low pressure turbine (LPT) performance lapse rate has been focused on the conditions for the large engine class size. This makes sense considering the majority of people travel via commercial airlines and the impact of additional fuel is directly felt on fares. The small engine class size that support business jet travel incur larger performance penalties due to the higher cruise altitude. Military high altitude applications, such as UCAV, result in LPT Reynolds number levels that are extremely low; the sturdiest turbine aerodynamicist will wobble at these operating conditions. The turbomachinery industry carries a confusion factor when discussing Reynolds number; that is the length term. The classic boundary layer equations point to the use of surface length, for turbine airfoils the typical selection is the suction surface length. The suction surface length is what researchers tend to use for presentation of experimental/computational results. The various turbine engine companies use different

length terms; axial chord, true chord, mean camber line length, and throat width. A review of available turbine rig tests shows Reynolds number variation data collapses best with the use of throat width. A blade row loss schematic is presented to support the use of throat width. Boundary layer management methods, passive and active, are being developed to control low Reynolds loss in turbines. Honeywell has teamed up with University of Arizona and Arizona State University to research the low Reynolds issue based on a recent low pressure turbine airfoil design. A low speed cascade test rig with wake generator device will be used to collect the data, CFD modeling and enhanced near wall schemes will complement the rig data. There are several items that need to be addressed to close the gap between research and industry, two will be discussed here. One is the turbulence intensity level discrepancy between the test rigs and the actual engine environment. A second issue is the appropriate simulation of the upstream blade row wakes in cascade testing, the popular approach to date is cylindrical bars.

Author

Low Pressure; Turbomachinery; Reynolds Number; Turbine Engines; Computational Fluid Dynamics; Wakes

20020067688 Imperial Coll. of Science and Technology, Dept. of Mechanical Engineering, London, UK

Mixed-Flow Turbine: Steady and Unsteady Performance With Detailed Flow Measurements

Martinez-Botas, Ricardo F., Imperial Coll. of Science and Technology, UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 459-496; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Turbochargers are finding increasing application to automotive diesel engines as cost-effective means for improving their power output and efficiency, and reducing exhaust emissions; these requirements have led to the need for highly loaded turbocharger turbines. A mixed-flow turbine is capable of achieving its peak isentropic efficiency at reduced velocity ratios compared to a typical radial inflow turbine, it is therefore possible to improve the turbocharger/engine matching. The steady and unsteady performance of a mixed flow turbocharger turbine with constant blade inlet angle has been investigated. The steady flow results indicated that the mixed flow turbine obtains a peak efficiency (total-to-static) of 75% at a velocity ratio of 0.61, which is lower when compared to a typical radial inflow turbine (peaking at around a 0.7 velocity ratio). In the unsteady flow performance tests, the cycle average isentropic efficiencies are higher for the mixed flow geometry than in a radial turbine. A substantial deviation from the performance and flow characteristics of the equivalent steady-state tests commonly used in turbocharger turbine design has been found. The pulsations from the engine have been followed through the inlet pipe and around the volute; the pulse has been shown to propagate close to the speed of sound and not according to the bulk flow velocity as stated by some researchers. The flow entering and exiting the blades has been quantified by a laser Doppler velocimetry system. The turbine test conditions corresponded to the peak efficiency point at 29,400 and 41,300 rpm. The results were resolved in a blade-to-blade sense to examine in greater detail the nature of the flow at turbocharger representative conditions. The unsteady flow characteristics have been investigated at two flow pulse frequencies, corresponding to internal combustion engine speeds of 1600 and 2400 rpm. Four measurement planes have been investigated: one in the pipe feeding the volute, two in the volute (40 deg. and 130 deg. downstream of the tongue) and one at the exit of the turbine. The pulse propagation at these planes has been investigated; the effect of the different planes on the evaluation of the unsteady isentropic efficiency is shown to be significant. The rotor inlet and exit velocity triangle under pulsating flow conditions has demonstrated a deviation from the optimum conditions based on steady-flow analysis.

Author

Steady Flow; Turbines; Flow Measurement; Performance Tests; Flow Characteristics; Unsteady Flow

20020069115 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA

Revolutionary/Unconventional Aeropropulsion Technology Evaluation through Thermodynamic Work Potential: A Revolutionary Aeropropulsion Concepts Program Research Initiative Quarterly Report, 6 May - 31 Jul. 2002

Mavris, Dimitri, Georgia Inst. of Tech., USA; Danner, Travis, Georgia Inst. of Tech., USA; Roth, Bryce, Georgia Inst. of Tech., USA; Aug. 10, 2002; 12p; In English

Contract(s)/Grant(s): NAG3-2586; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is intended as a status report for activities covered May through July 2002 under the auspices of NASA Glenn's Revolutionary Aeropropulsion Concepts (RAC) project. This is the first phase I quarterly report and as such, considerable focus will be given to defining the basic need and motivation driving this research effort. In addition, background research has been ongoing for the past several months and has culminated in considerable information pertaining to the state-of-the-art in work

potential analysis methods. This work is described in detail herein. Finally, the proposed analysis approach is described, as are the various ancillary concepts required for its implementation.

Author

Research and Development; Propulsion; Aircraft Engines; Technology Assessment; Systems Engineering; Thermodynamics; Project Planning

20020070525 Toledo Univ., OH USA

Low-Pressure Turbine Separation Control: Comparison With Experimental Data *Final Report*

Garg, Vijay K., Toledo Univ., USA; July 2002; 12p; In English; Turbo Expo 2002, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): NAS3-00180; NCC3-926; RTOP 708-73-43

Report No.(s): NASA/CR-2002-211689; NAS 1.26:211689; E-13419; GT-2002-30229; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present work details a computational study, using the Glenn HT code, that analyzes the use of vortex generator jets (VGJs) to control separation on a low-pressure turbine (LPT) blade at low Reynolds numbers. The computational results are also compared with the experimental data for steady VGJs. It is found that the code determines the proper location of the separation point on the suction surface of the baseline blade (without any VGJ) for Reynolds numbers of 50,000 or less. Also, the code finds that the separated region on the suction surface of the blade vanishes with the use of VGJs. However, the separated region and the wake characteristics are not well predicted. The wake width is generally over-predicted while the wake depth is under-predicted.

Author

Computation; Vortex Generators; Low Pressure; Turbines; Jet Flow

20020070605 NASA Glenn Research Center, Cleveland, OH USA

Overview of High-Fidelity Modeling Activities in the Numerical Propulsion System Simulations (NPSS) Project

Veres, Joseph P., NASA Glenn Research Center, USA; June 2002; 10p; In English; Aerospace Numerical Simulation Symposium, 20-22 Jun. 2001, Tokyo, Japan; Sponsored by National Aerospace Lab., Japan

Contract(s)/Grant(s): RTOP 704-31-63

Report No.(s): NASA/TM-2002-211351; NAS 1:15:211351; E-13169; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A high-fidelity simulation of a commercial turbofan engine has been created as part of the Numerical Propulsion System Simulation Project. The high-fidelity computer simulation utilizes computer models that were developed at NASA Glenn Research Center in cooperation with turbofan engine manufacturers. The average-passage (APNASA) Navier-Stokes based viscous flow computer code is used to simulate the 3D flow in the compressors and turbines of the advanced commercial turbofan engine. The 3D National Combustion Code (NCC) is used to simulate the flow and chemistry in the advanced aircraft combustor. The APNASA turbomachinery code and the NCC combustor code exchange boundary conditions at the interface planes at the combustor inlet and exit. This computer simulation technique can evaluate engine performance at steady operating conditions. The 3D flow models provide detailed knowledge of the airflow within the fan and compressor, the high and low pressure turbines, and the flow and chemistry within the combustor. The models simulate the performance of the engine at operating conditions that include sea level takeoff and the altitude cruise condition.

Author

Gas Turbine Engines; Computational Fluid Dynamics; Turbomachinery; Combustion Chambers; Three Dimensional Models; Computerized Simulation

20020070627 NASA Glenn Research Center, Cleveland, OH USA

Self-Recirculating Casing Treatment Concept for Enhanced Compressor Performance

Hathaway, Michael D., Army Research Lab., USA; July 2002; 15p; In English; Turbo Expo 2002, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 714-03-20; DA Proj. 1L1-61102-AH-45

Report No.(s): NASA/TM-2002-211569; E-13353; NAS 1.15:211569; ARL-TR-2748; GT-2002-30368; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A state-of-the-art CFD code (APNASA) was employed in a computationally based investigation of the impact of casing bleed and injection on the stability and performance of a moderate speed fan rotor wherein the stalling mass flow is controlled by tip flow field breakdown. The investigation was guided by observed trends in endwall flow characteristics (e.g., increasing endwall

aerodynamic blockage) as stall is approached and based on the hypothesis that application of bleed or injection can mitigate these trends. The "best" bleed and injection configurations were then combined to yield a self-recirculating casing treatment concept. The results of this investigation yielded: 1) identification of the fluid mechanisms which precipitate stall of tip critical blade rows, and 2) an approach to recirculated casing treatment which results in increased compressor stall range with minimal or no loss in efficiency. Subsequent application of this approach to a high speed transonic rotor successfully yielded significant improvements in stall range with no loss in compressor efficiency.

Author

Computational Fluid Dynamics; Rotating Stalls; Rotors; Stability; Flow Distribution

20020070655 Rolls-Royce Allison, Indianapolis, IN USA

Lobed Mixer Design for Noise Suppression Acoustic and Aerodynamic Test Data Analysis Final Report

Mengle, Vinod G., Rolls-Royce Allison, USA; Dalton, William N., Rolls-Royce Allison, USA; July 2002; 297p; In English

Contract(s)/Grant(s): NAS3-27394; RTOP 781-30-12

Report No.(s): NASA/CR-2002-210823/VOL1; NAS 1.26:210823/VOL1; E-12741-1-VOL1; EDR-18580/VOL1; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

A comprehensive database for the acoustic and aerodynamic characteristics of several model-scale lobe mixers of bypass ratio 5 to 6 has been created for mixed jet speeds up to 1080 ft/s at typical take-off (TO) conditions of small-to-medium turbofan engines. The flight effect was simulated for Mach numbers up to 0.3. The static thrust performance and plume data were also obtained at typical TO and cruise conditions. The tests were done at NASA Lewis anechoic dome and ASK's FluiDyne Laboratories. The effect of several lobe mixer and nozzle parameters, such as, lobe scalloping, lobe count, lobe penetration and nozzle length was examined in terms of flyover noise at constant altitude. Sound in the nozzle reference frame was analyzed to understand the source characteristics. Several new concepts, mechanisms and methods are reported for such lobed mixers, such as, "boomerang" scallops, "tongue" mixer, detection of "excess" internal noise sources, and extrapolation of flyover noise data from one flight speed to different flight speeds. Noise reduction of as much as 3 EPNdB was found with a deeply scalloped mixer compared to annular nozzle at net thrust levels of 9500 lb for a 29 in. diameter nozzle after optimizing the nozzle length.

Author

Data Bases; Acoustic Properties; Aerodynamic Characteristics; Aerodynamic Noise; Scale Models; Jet Flow; Aircraft Noise; Noise Reduction; Velocity

08

AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.

20020068949 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA

Workstation-Based Simulation for Rapid Prototyping and Piloted Evaluation of Control System Designs

Mansur, M. Hossein, Army Aviation and Missile Command, USA; Colbourne, Jason D., California Polytechnic State Univ., USA; Chang, Yu-Kuang, Raytheon STX Corp., USA; [1998]; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The development and optimization of flight control systems for modern fixed- and rotary- wing aircraft consume a significant portion of the overall time and cost of aircraft development. Substantial savings can be achieved if the time required to develop and flight test the control system, and the cost, is reduced. To bring about such reductions, software tools such as Matlab/Simulink are being used to readily implement block diagrams and rapidly evaluate the expected responses of the completed system. Moreover, tools such as CONDUIT (CONtroller Designer's Unified InTeface) have been developed that enable the controls engineers to optimize their control laws and ensure that all the relevant quantitative criteria are satisfied, all within a fully interactive, user friendly, unified software environment.

Derived from text

Simulation; Workstations; Prototypes; Pilots (Personnel); Evaluation; Control Systems Design

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronautical facilities see 14 Ground Support Systems and Facilities (Space).

20020068030 Corps of Engineers, Washington, DC USA

Engineering and Design: Evaluation of Military Airfield Pavements

Jan. 29, 1988; 2p; In English

Report No.(s): AD-A404013; ER-1110-3-108; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This regulation sets forth policy and responsibilities for evaluation of military airfield pavements. This regulation applies to all HQUSACE/OCE elements and field operating activities (FOA) having military construction and design responsibility. Information concerning aircraft inventory, aircraft passes and aircraft operations shall not be released outside U.S. Government agencies. Unless otherwise approved by CEEC-EG, all U.S. Army Airfield Pavement Evaluation will be performed by the U.S. Army Corps of Engineers Waterways Experiment Station. Portions of the airfield pavement evaluation reports containing references to aircraft inventory, passes and operations shall not be released outside U.S. Government agencies. U.S. Army Airfield Pavement Condition Index without reference to aircraft operations may be released to Architect/Engineer with the approval of CEEC-EG. For airfields which are not U.S. Army, any release of pavement evaluation information made outside of the Department of the Army shall be made by the owner of the airfield, not by the U.S. Army Corps of Engineers.

DTIC

Pavements; Landing Sites; Flight Operations; Fabrication; Architecture

20020068031 Corps of Engineers, Washington, DC USA

Engineering and Design: Design of Military Airfield Pavements

Jan. 29, 1988; 2p; In English

Report No.(s): AD-A404010; ER-1110-3-107; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This regulation sets forth policy and responsibilities for design of military airfield pavements. This regulation applies to all HQUSACE/OCE elements and all field operating activities (FOA) having military construction and design responsibility. Information concerning aircraft inventory, aircraft passes and aircraft operations shall not be released outside U.S. Government agencies. Airfield pavement design requiring aircraft operation criteria shall be accomplished by the Corps of Engineers. The thickness, width, length and marking of the pavement may be released to a design organization providing that all references to "aircraft operations" are removed. U.S. Army Airfield Pavement Design may be released only to U.S. Department of Defense agencies. For airfields which are not U.S. Army, any release of design information made outside of the Department of the Army shall be made by the owner of the airfield, not by the U.S. Army Corps of Engineers.

DTIC

Pavements; Construction; Flight Operations; Fabrication; Landing Sites

20020069113 National Aerospace Lab., Amsterdam Netherlands

Flight Simulator Evaluation of the Safety Benefits of Terrain Awareness and Warning Systems

deMuynck, R. J.; Khatwa, R.; Sep. 1999; In English

Report No.(s): PB2002-105874; NLR-TP-99379; No Copyright; Avail: National Technical Information Service (NTIS)

This paper focuses on an investigation into the operational safety aspects of advanced Terrain Awareness and Warning Systems (TAWS), conducted under contract to the Netherlands Directorate General of Civil Aviation (RLD). The TAWS depicts graphical terrain information on a Navigation Display (ND) and provides predictive terrain collision alerting. Initially, several ND terrain format displays were evaluated in an exploratory workstation study. The most preferred display format was adopted for follow-up evaluations in a piloted simulation programme. The objective of phase two was to evaluate the independent effects of terrain awareness information and predictive terrain alerting. The NLR Research Flight Simulator employing the Fokker 100 model served as the test facility. Ten evaluation crews flew fourteen scenarios each, primarily in terrain-rich environments.

NTIS

Flight Simulators; Aircraft Safety; Warning Systems; Terrain; General Aviation Aircraft

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.

20020067775 General Accounting Office, Washington, DC USA

Defense Space Activities: Status of Reorganization

Schuster, Carol R.; Jun. 26, 2002; 21p; In English; Testimony before the Committee on Armed Services, USA Senate and the Committee on Armed Services, House of Representatives

Report No.(s): AD-A403821; GAO-02-772R; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA depends on space technology for a variety of national security activities as well as commercial operations. Space technology is integral to such diverse activities as transportation, health, the environment, communications, commerce, agriculture, and energy. However, the commercial, scientific, and military importance of U.S. space assets creates vulnerabilities that potential adversaries could exploit. Addressing these vulnerabilities presents challenges for the national security space community. As you know, the Congress has had long-standing concerns about the Department of Defense's organization and management of national security space activities, including the lack of a focal point for space policy, inadequate department-level oversight, inadequate coordination between military and intelligence organizations, lack of defined responsibilities for space programs, and insufficient responsiveness to space systems users. The Congress chartered the Commission to Assess United States National Security Space Management and Organization to assess the organization and management of space activities that support U.S. national security interests and make recommendations for improvements. The present Secretary of Defense, prior to his assuming his current position, led the commission, known as the Space Commission.

DTIC

Space Programs; Aerospace Engineering; Aerospace Systems

20020067792 Marine Corps Schools, Command and Staff Coll., Quantico, VA USA

The Space Maneuver Vehicle: Enhancing Space's Utility to the Warfighter

Davis, Stephen L.; Jan. 2002; 52p; In English; Original contains color images

Report No.(s): AD-A404007; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Space is a critical enabler for our military force. Current space systems, however, have significant deficiencies in the ability to provide Space Superiority (the purpose of space control) and lack operational responsiveness. The rapid response, quick turnaround, and high on-orbit maneuverability of the Space Maneuver Vehicle can correct these shortfalls; it provides space asset protection that enables U.S. forces to achieve and maintain Space Superiority. Its ability to co-orbit with friendly space assets and provide on-orbit servicing and repair will extend the service life of other satellites. The ability to deploy SMVs with a mix of intelligence, surveillance, and reconnaissance (ISR) payloads will provide an affordable, responsive and sustained presence to support diverse theaters of operation. The ability to integrate, operate, and recover and reuse the SMV with a variety of onboard or deployed payloads provides operational flexibility heretofore unattainable with traditional satellites. Finally, the SMV's operational flexibility will provide an opportunity fundamentally change the command and control of space systems in order to push control down to the theater CINC thus allowing the true integration of space into theater operations.

DTIC

Spacecraft; Aerospace Systems; Function Space; Deployment

20020068450 NASA Marshall Space Flight Center, Huntsville, AL USA

Estimating the Cost of NASA's Space Launch Initiative: How SLI Cost Stack Up Against the Shuttle

Hamaker, Joseph H., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; SSCAG Meeting, 11-13 Jun. 2002, Frascati, Italy; Sponsored by Space Systems Cost Analysis Group, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

NASA is planning to replace the Space Shuttle with a new completely reusable Second Generation Launch System by approximately 2012. Numerous contracted and NASA in-house Space Transportation Architecture Studies and various technology maturation activities are proceeding and have resulted in scores of competing architecture configurations being proposed. Life cycle cost is a key discriminator between all these various concepts. However, the one obvious analogy for costing purposes remains the current Shuttle system. Are there credible reasons to believe that a second generation reusable launch system can be accomplished at less cost than the Shuttle? The need for a credible answer to this question is critical. This paper reviews

the cost estimating approaches being used by the contractors and the government estimators to address this issue and explores the rationale behind the numbers.

Author

Space Shuttles; Life Cycle Costs; Cost Estimates; Reusable Launch Vehicles

20020068706 NASA Marshall Space Flight Center, Huntsville, AL USA

Commercial Research and Development: Power to Explore, Opportunities from Discovery

Casas, Joseph C., NASA Marshall Space Flight Center, USA; Nall, Mark, NASA Marshall Space Flight Center, USA; Powers, C. Blake, NASA Marshall Space Flight Center, USA; [2002]; 2p; In English; 23rd International Symposium on Space Technology and Science, 26 May - 2 Jun. 2002, Matsue, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

The technical and economic goals of commercial use of space are laudable, and are addressed as a high priority by almost every national space program and most major aerospace companies the world over. Yet, the focus of most organizational agendas and discussions tends to focus on one or two very narrow enabling aspects of this potentially large technological and economic opportunity. While government sponsored commercial launch activities and private space platforms are an integral part of efforts to leverage the commercial use of space, these activities are possibly one of the smallest parts of creating a viable and sustainable market for the commercial use of space. Most of the current programs usually do not appropriately address some of the critical issues of the current, already interested, potential space user communities. Current programs place the focus of the majority of the user requirements on the vehicle payload weight and mass performance considerations as the primary payload economical factor in providing a commercial market with a stimulating price for gaining access to the space environment. The larger user challenges of transformation from Earth-based research and development approaches to space environment approaches are not addressed early enough in programs to impact the new business considerations of potential users. Currently, space-based research and development user activities require a large user investment in time, in development of new areas of support expertise, in development of new systems, in risk of schedule to completion, and in long term capital positioning. The larger opportunities for stimulating a strong market driven interest in commercial use of space that could result from the development of vehicle payload "leap ahead technologies" for users are being missed, and there is a real risk of limiting the potentially broader market base to support a more technologically advanced and economically lucrative outcome. A major driving force for strengthening the commercial space activities is not only the technological advances in launch vehicle, or newer satellites, but the myriad of enabling payloads technologies that could, as a goal, result in an almost transparent facilitation to regular CD a, -n access to space and microgravity environments by the future users from the existing Earth-based research and development organizations market segments. Rather than focusing only on developing high lift performance launch vehicles and then developing payloads to fit them, the real focus from a business model perspective should to be on the customer payloads requirements, and on designing launch vehicles and platforms systems for a space transportation and facility infrastructure to support all aspects of the business model for the user market. To harness the full potential of space commercialization, new efforts need to be made to comprehensively examine all the critical business model areas for commercial research, development, and manufacturing in space so as to identify specific products and efforts; to determine how such operations must be both similar to and different from current Earth-based activities; to evaluate the enabling technological devices, processes and efforts so that like efforts can be addressed in a synergistic fashion for maximum user cost effectiveness; to delineate the services that are both needed and can be provided by such activities; and to use this information to drive design and development of space commercialization efforts and policy.

Author

Payloads; Space Commercialization; User Requirements; Research and Development; Launch Vehicles; Commercial Spacecraft

20020068798 Queensborough Community Coll., Mathematics and Computer Science Dept., Bayside, NY USA

Small Objects in Low-Earth Intersecting Ground-Based Laser Radar Operational Envelopes

Boccio, Dona V., Queensborough Community Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. VI-1 - VI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

NASA/Marshall Space Flight Center, in collaboration with the Air Force Research Laboratory/Directed Energy Directorate, is considering a series of experiments to demonstrate small object tracking capability. One such experiment involves a microsatellite, about 25 cm in diameter, which will be deployed from a Space Shuttle Hitchhiker canister or from an Air Force vehicle. The High Performance CO2 Ladar Surveillance Sensor (HI-CLASS) and the Advanced Electro-Optics System (AEOS) will be used to detect the micro-satellite. The goal of this paper is to determine the number of times per day that a micro-satellite

orbiting at a known altitude and inclination will be visible to the laser radar, and the length of time that the micro-satellite will be visible on each pass.

Derived from text

Microsatellites; Optical Radar; Satellite Tracking

20020068945 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Overview of Trajectory Design Operations for the Microwave Anisotropy Probe (MAP) Mission

Cuevas, Osvaldo O., NASA Goddard Space Flight Center, USA; Newman-Kraft, Lauri, NASA Goddard Space Flight Center, USA; Mesarch, Michael A., NASA Goddard Space Flight Center, USA; Woodard, Mark A., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; AIAA/AAS Astrodynamics Specialist Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The main science objective of the Microwave Anisotropy Probe (MAP) mission is to produce an accurate full-sky map of the cosmic microwave background temperature fluctuations - anisotropy. MAP will collect these measurements from a lissajous orbit about the Sun-Earth/Moon L2 Lagrange Point. The NASA Goddard Space Flight Center (GSFC) Flight Dynamics Analysis Branch provided mission analysis, maneuver planning and maneuver calibration for the MAP spacecraft. This paper will provide an overview of the MAP trajectory design, a summary of the maneuvers executed. Differences from the pre-launch nominal plan will also be discussed. During the MAP phasing loops, MAP performed three calibration maneuvers in order to characterize the performance of the primary sets of thrusters - +X, +Z, and -Z. The calibration maneuvers were designed to minimize their impact on the trajectory. Four maneuvers were performed to set up the gravity assist of the Moon - required to propel MAP out to its orbit about L2. These maneuvers were performed at the three phasing loop perigees and at 18 hours after the final perigee. It became necessary to alter some of the perigee maneuvers in order to shape the gravity assist. This shaping was done to help meet some mission goals. In particular, the gravity assist was changed slightly in order to remove lunar shadows in both the cruise out to L2 and in the first revolution about L2. This amounted to a change in the phasing loop AV of less than 1 m/s. After the gravity assist, two mid-course correction (MCC) maneuvers were performed in order to fine-tune the trajectory. MCC1 was used to clean up and errors which resulted from the gravity assist. MCC2 was performed in order to mitigate a large stationkeeping maneuver following a crucial instrument calibration period during the cruise phase. MAP executed its first stationkeeping maneuver in January 16th and is ready for a second calibration period during late Winter / early Spring. Further information concerning subsequent stationkeeping maneuver will be added as they become available.

Author

Trajectories; Design Analysis; Microwave Probes; Anisotropy; Microwaves; Cosmic Microwave Background Radiation

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LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

20020068806 Alabama Agricultural and Mechanical Univ., Dept. of Management and Marketing, Normal, AL USA

Second Generation Reusable Launch Vehicle Development and Global Competitiveness of US Space Transportation Industry: Critical Success Factors Assessment

Enyinda, Chris I., Alabama Agricultural and Mechanical Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XIV-1 - XIV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

In response to the unrelenting call in both public and private sectors fora to reduce the high cost associated with space transportation, many innovative partially or fully RLV (Reusable Launch Vehicles) designs (X-34-37) were initiated. This call is directed at all levels of space missions including scientific, military, and commercial and all aspects of the missions such as nonrecurring development, manufacture, launch, and operations. According to Wertz, tbr over thirty years, the cost of space access has remained exceedingly high. The consensus in the popular press is that to decrease the current astronomical cost of access to space, more safer, reliable, and economically viable second generation RLVs (SGRLV) must be developed. Countries such as Brazil, India, Japan, and Israel are now gearing up to enter the global launch market with their own commercial space launch vehicles. NASA and the US space launch industry cannot afford to lag behind. Developing SGRLVs will immeasurably improve the US's space transportation capabilities by helping the US to regain the global commercial space markets while supporting the transportation capabilities of NASA's space missions, Developing the SGRLVs will provide affordable commercial space transportation that will assure the competitiveness of the US commercial space transportation industry in the 21st century.

Commercial space launch systems are having difficulty obtaining financing because of the high cost and risk involved. Access to key financial markets is necessary for commercial space ventures. However, public sector programs in the form of tax incentives and credits, as well as loan guarantees are not yet available. The purpose of this paper is to stimulate discussion and assess the critical success factors germane for RLVs development and US global competitiveness.

Derived from text

Cost Reduction; Reusable Launch Vehicles; Space Commercialization; Research and Development; Commercial Spacecraft; NASA Programs

20020070521 Wyoming Univ., Mechanical Engineering Dept., Laramie, WY USA

Reduction of Base Drag on Launch Vehicles *Final Report, Mar. 2000 - Mar. 2002*

Naughton, Jonathan W., Wyoming Univ., USA; [2002]; 17p; In English

Contract(s)/Grant(s): NAG4-208

Report No.(s): UWAL-2002-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current reentry vehicle designs exhibit large amounts of base drag due to large base areas. These large base areas can arise from the integration of the propulsion system (X-33) or control surface placement (X-38). Large base drag limits the vehicle's cross-range capability and causes a large glide-slope angle. Fortunately, there appears to be a possible means of lowering the base drag on these vehicles. Based on early work on the subsonic aerodynamics of lifting bodies, it appears that the addition of small amounts of viscous fore-body drag can produce a significant reduction in base drag. Recent work suggests that this phenomenon also occurs in the transonic and supersonic flight regimes. This report summarizes a study designed to demonstrate the reduction of base drag through the addition of fore-body viscous drag. The present study has focused on the measurement of viscous fore-body drag and the demonstration of the relationship between fore-body viscous drag and base drag at Reynolds Numbers up to 2.5×10^6 . The results of the present work do not conclusively demonstrate that viscous fore-body drag reduces base drag. The apparent contradictory results of the present study are attributed to the different geometry used in the present study. However, the results suggest that the increased boundary layer thickness at separation caused by larger fore-body viscous drag somehow affects the vortex structure in the wake thereby reducing the base drag. More research is required to confirm this postulated mechanism.

Author

Base Flow; Drag Reduction; Reentry Vehicles; Viscous Drag; Aerodynamic Drag; Forebodies

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.

20020067714 NASA Goddard Space Flight Center, Greenbelt, MD USA

Formation Flying Satellite Control Around the L2 Sun-Earth Libration Point

Hamilton, Nicholas H., Air Force Academy, USA; Folta, David, NASA Goddard Space Flight Center, USA; Carpenter, Russell, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; AIAA/AAS Astrodynamics Specialist Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A growing interest in formation flying satellites demands development and analysis of control and estimation algorithms for station-keeping and formation maneuvering. This paper discusses the development of a discrete linear-quadratic-regulator control algorithm for formations in the vicinity of the L2 sun-earth libration point. The development of an appropriate Kalman filter is included as well. Simulations are created for the analysis of the station-keeping and various formation maneuvers of the Stellar Imager mission. The simulations provide tracking error, estimation error, and control effort results. From the control effort, useful design parameters such as delta V and propellant mass are determined. For formation maneuvering, the formation spacecraft track to within 4 meters of their desired position and within 1.5 millimeters per second of their desired zero velocity. The filter, with few exceptions, keeps the estimation errors within their three-sigma values. Without noise, the controller performs extremely well,

with the formation spacecraft tracking to within several micrometers. Each spacecraft uses around 1 to 2 grams of propellant per maneuver, depending on the circumstances.

Author

Formation Flying; Sun; Earth (Planet); Libration; Satellite Attitude Control; Algorithms

20020067729 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Maneuver Planning Process for the Microwave Anisotropy Probe (MAP) Mission

Mesarch, Michael A., NASA Goddard Space Flight Center, USA; Andrews, Stephen, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; AIAA/AAS Astrodynamics Specialist Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Microwave Anisotropy Probe (MAP) was successfully launched from Kennedy Space Center's Eastern Range on June 30, 2001. MAP will measure the cosmic microwave background as a follow up to NASA's Cosmic Background Explorer (COBE) mission from the early 1990's. MAP will take advantage of its mission orbit about the Sun-Earth/Moon L2 Lagrangian point to produce results with higher resolution, sensitivity, and accuracy than COBE. A strategy comprising highly eccentric phasing loops with a lunar gravity assist was utilized to provide a zero-cost insertion into a lissajous orbit about L2. Maneuvers were executed at the phasing loop perigees to correct for launch vehicle errors and to target the lunar gravity assist so that a suitable orbit at L2 was achieved. This paper will discuss the maneuver planning process for designing, verifying, and executing MAP's maneuvers. A discussion of the tools and how they interacted will also be included. The maneuver planning process was iterative and crossed several disciplines, including trajectory design, attitude control, propulsion, power, thermal, communications, and ground planning. Several commercial, off-the-shelf (COTS) packages were used to design the maneuvers. STK/Astrogator was used as the trajectory design tool. All maneuvers were designed in Astrogator to ensure that the Moon was met at the correct time and orientation to provide the energy needed to achieve an orbit about L2. The Mathworks Matlab product was used to develop a tool for generating command quaternions. The command quaternion table (CQT) was used to drive the attitude during the perigee maneuvers. The MatrixX toolset, originally written by Integrated Systems, Inc., now distributed by Mathworks, was used to create HiFi, a high fidelity simulator of the MAP attitude control system. HiFi was used to test the CQT and to make sure that all attitude requirements were met during the maneuver. In addition, all ACS data plotting and output were generated in MatrixX. A final test used FlatSat, a real-time hardware-in-the-loop simulator, which used identical MAP flight code to simulate operations on the spacecraft. Simulations in FlatSat allowed the MAP team to verify maneuver commands, timing, and spacecraft configuration before the commands were sent up to the spacecraft for execution. The MAP maneuver team successfully pieced together all of these COTS tools for designing MAP's maneuvers and MAP is now collecting data at L2.

Author

Anisotropy; Cosmic Background Explorer Satellite; Earth-Moon System; Sun; Spacecraft Maneuvers; Space Probes; Microwaves

20020067761 NASA Marshall Space Flight Center, Huntsville, AL USA

Technology Development Activities for the Space Environment and Its Effects On Spacecraft

Kauffman, Billy, NASA Marshall Space Flight Center, USA; Hardage, Donna, NASA Marshall Space Flight Center, USA; Minor, Jody, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; AIAA/ICAS International Air and Space Symposium and Exposition: The Next 100 Years, Jul. 2003, Dayton, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Reducing size and weight of spacecraft, along with demanding increased performance capabilities, introduces many uncertainties in the engineering design community on how emerging microelectronics will perform in space. The engineering design community is forever behind on obtaining and developing new tools and guidelines to mitigate the harmful effects of the space environment. Adding to this complexity is the push to use Commercial-off-the-Shelf (COTS) and shrinking microelectronics behind less shielding and the potential usage of unproven technologies such as large solar sail structures and nuclear electric propulsion. In order to drive down these uncertainties, various programs are working together to avoid duplication, save what resources are available in this technical area and possess a focused agenda to insert these new developments into future mission designs. This paper will describe the relationship between the Living With a Star: Space Environment Testbeds Project and NASA's Space Environments and Effects (SEE) Program and their technology development activities funded as a result from the recent SEE Program's NASA Research Announcement.

Author

Aerospace Environments; Microelectronics; Shielding; Solar Sails

20020067776 NASA Goddard Space Flight Center, Greenbelt, MD USA

Results of NASA's First Autonomous Formation Flying Experiment: Earth Observing-1 (EO-1)

Folta, David, NASA Goddard Space Flight Center, USA; Hawkins, Albin, AI Solutions, Inc., USA; [2002]; 1p; In English; AIAA/AAS Astrodynamics Specialist Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA's first autonomous formation flying mission completed its primary goal of demonstrating an advanced technology called enhanced formation flying. To enable this technology, the Flight Dynamics Analysis Branch at the Goddard Space Flight Center implemented a universal 3-axis formation flying algorithm in an autonomous executive flight code onboard the New Millennium Program's (NMP) Earth Observing-1 (EO-1) spacecraft. This paper describes the mathematical background of the autonomous formation flying algorithm, the onboard flight design and the validation results of this unique system. Results from fully autonomous maneuver control are presented as comparisons between the onboard EO-1 operational autonomous control system called AutoCon, its ground-based predecessor used in operations, and the original standalone algorithm. Maneuvers discussed encompass reactionary, routine formation maintenance, and inclination control. Orbital data is also examined to verify that all formation flying requirements were met.

Author

Autonomy; Formation Flying; Earth Observing System (EOS); Algorithms; NASA Programs

20020068009 New Mexico State Univ., Las Cruces, NM USA

Pyrotechnically Operated Valves for Testing and Flight

Conley, Edgar G., New Mexico State Univ., USA; [2002]; 6p; In English

Contract(s)/Grant(s): NAG13-02046; RTOP 334-20-00-00-00-64; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Pyrovalves still warrant careful description of their operating characteristics, which is consistent with the NASA mission - to assure that both testing and flight hardware perform with the utmost reliability. So, until the development and qualification of the next generation of remotely controlled valves, in all likelihood based on shape memory alloy technology, pyrovalves will remain ubiquitous in controlling flow systems aloft and will possibly see growing use in ground-based testing facilities. In order to assist NASA in accomplishing this task, we propose a three-phase, three-year testing program. Phase I would set up an experimental facility, a 'test rig' in close cooperation with the staff located at the White Sands Test Facility in Southern New Mexico.

Derived from text

Fuel Valves; Structural Reliability; Design Analysis

20020068016 NASA Marshall Space Flight Center, Huntsville, AL USA

Restraining Loose Equipment Aboard the International Space Station: The Payload Equipment Restraint System

Smith, Kenneth A., NASA Marshall Space Flight Center, USA; Reynolds, D. W., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 23rd International Symposium on Space Technology and Science, 26 May - 2 Jun. 2002, Matsue, Japan Report No.(s): ISTS-2002-f-28; No Copyright; Avail: Issuing Activity; Abstract Only

As the International Space Station (ISS) grows, so do the supplies and equipment needed to support its daily operations. Each day many items must be unstowed and relocated to various worksites so they are readily available to the crew. Due to the lack of gravity, these items may become loose and float away if not restrained. The Payload Equipment Restraint System was developed to meet the new and unique challenge of restrain no loose equipment aboard the ISS.

Author

International Space Station; Payloads; Onboard Equipment; Constraints

20020068481 NASA Marshall Space Flight Center, Huntsville, AL USA

Characterization of Space Environmental Effects on Candidate Solar Sail Material

Edwards, David, NASA Marshall Space Flight Center, USA; Hubbs, Whitney, NASA Marshall Space Flight Center, USA; Stanaland, Tesia, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 47th SPIE Annual Meeting: International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The National Aeronautics and Space Administration's (NASA) Marshall Space Flight Center (MSFC) is concentrating research into the utilization of photonic materials for spacecraft propulsion. Spacecraft propulsion, using photonic materials, will be achieved using a solar sail. A solar sail operates on the principle that photons, originating from the sun, impart pressure to the sail and therefore provide a source for spacecraft propulsion. The pressure imparted to a solar sail can be increased, up to a factor of two if the sunfacing surface is perfectly reflective. Therefore, these solar sails are generally composed of a highly reflective

metallic sun-facing layer, a thin polymeric substrate and occasionally a highly emissive back surface. The Space Environmental Effects Team, at MSFC, is actively characterizing candidate solar sail material to evaluate the thermo-optical and mechanical properties after exposure to radiation environments simulating orbital environments. This paper describes the results of three candidate materials after exposure to a simulated Geosynchronous Transfer Orbit (GTO). This is the first known characterization of solar sail material exposed to space simulated radiation environments. The technique of radiation dose versus material depth profiling was used to determine the orbital equivalent exposure doses. The solar sail exposure procedures and results of the material characterization will be discussed.

Author

Photonic Propulsion; Space Environment Simulation; Materials Selection; Solar Sails; Radiation Damage; Space Weathering

20020068821 Pace Univ., Dept. of Chemistry and Physical Sciences, New York, NY USA

The Solar-Sail Launched Interstellar Probe: Pre-Perihelion Trajectories and Application of Holography

Matloff, Gregory L., Pace Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXX-1 - XXX-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Design of missions beyond our solar system presents many challenges. Here, we consider certain aspects of the solar-sail launched interstellar probe (ISP), a spacecraft slated for launch in the 2010 time period that is planned to reach the heliopause, at 200 Astronomical Units (AU) from the Sun after a flight of about 20-years duration. The baseline mission under consideration by NASA / JPL has a sail radius of 200 m, a science payload of 25 kg, a spacecraft areal mass thickness of about two grams per square meter and is accelerated out of the solar system at about 14 AU per year after performing a perihelion pass of about 0.25 AU. In current plans, the sail is to be dropped near Jupiter's orbit (5.2 AU from the Sun) on the outbound trajectory leg. One aspect of this study is application of a realistic model of sail thermo-optics to sail kinematics that includes diffuse / specular reflectance and sail roughness. The effects of solar-wind degradation of sail material, based on recent measurements at the NASA MSFC (Marshall Space Flight Center) Space Environment Facility were incorporated in the kinematical model. After setting initial and final conditions for the spacecraft, trajectory was optimized using the provision of variable sail aspect angle. The second phase of the study included consideration of rainbow holography as a medium for a message plaque that would be carried aboard the ISP in the spirit of the message plaques aboard Pioneer 10 /11 and Voyager 1 /2. A prototype holographic message plaque was designed and created by artist C. Bangs with the assistance of Ana Maria Nicholson and Dan Schweitzer of the Center for Holographic Arts in Long Island City, NY. The piece was framed by Simon Liu Inc. of Brooklyn, NY. Concurrent to the creation of the prototype message plaque, we explored the potential of this medium to transmit large amounts of visual information to any extraterrestrial civilization that might detect and intercept ISP. It was also necessary to investigate possible degradation of holograms by the space environment. We developed a new way of characterizing the optical quality of holograms.

Author

Spacecraft Trajectories; Solar Sails; Kinematics; Interstellar Spacecraft; Holography; Extraterrestrial Communication

20020068839 Illinois Univ., Dept. of Aeronautical and Astronautical Engineering, Urbana-Champaign, IL USA

Orbital Propagation of Momentum Exchange Tether Systems

Westerhoff, John, Illinois Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. LIII-1 - LIII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

An advanced concept in in-space transportation currently being studied is the Momentum-Exchange/Electrodynamic Reboost Tether System (MXER). The system acts as a large momentum wheel, imparting a Δv to a payload in low earth orbit (LEO) at the expense of its own orbital energy. After throwing a payload, the system reboosts itself using an electrodynamic tether to push against Earth's magnetic field and brings itself back up to an operational orbit to prepare for the next payload. The ability to reboost itself allows for continued reuse of the system without the expenditure of propellants. Considering the cost of lifting propellant from the ground to LEO to do the same Δv boost at \$10000 per pound, the system cuts the launch cost of the payload dramatically, and subsequently, the MXER system pays for itself after a small number of missions. One of the technical hurdles to be overcome with the MXER concept is the rendezvous maneuver. The rendezvous window for the capture of the payload is on the order of a few seconds, as opposed to traditional docking maneuvers, which can take as long as necessary to complete a precise docking. The payload, therefore, must be able to match its orbit to meet up with the capture device on the end of the tether at a specific time and location in the future. In order to be able to determine that location, the MXER system must be numerically propagated forward in time to predict where the capture device will be at that instant. It should be kept in mind that the propagation computation must be done faster than real-time. This study focuses on the efforts to find and/or build the tools necessary to numerically propagate the motion of the MXER system as accurately as possible.

Author

Motion Simulation; Tethering; Orbital Rendezvous; Payloads

20020068977 NASA Goddard Space Flight Center, Greenbelt, MD USA

Prelaunch Instrument Calibration in the Real World: The GOES Example

Murphy-Morris, J., NASA Goddard Space Flight Center, USA; Wack, E., Massachusetts Inst. of Tech., USA; Oct. 01, 2002; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The pre-launch ground infrared calibration of the Geostationary Operational Environmental Satellite (GOES) N-Q Imager and Sounder is presented. Ground calibration provides information necessary to the accurate on-orbit calibration of these radiometers. Infrared channels are calibrated in a thermal vacuum environment, under minimum and maximum mission operation temperatures, using a variable-temperature warm target to simulate the Earth scene and a cold target to simulate the space scene. Brightness temperatures derived from observation of the instrument internal calibration target, used for on-orbit calibration, are compared to brightness temperatures of the external calibration target as a check of relative accuracy using these two sources. Changes to the GOES N-Q specification from GOES I-M are highlighted, as well as results of noise, relative calibration accuracy, and spectral response performance to date. For completeness, results of spatial and pointing performance will be presented. Enhancements to test methodology and data processing techniques are highlighted throughout.

Author

Accuracy; Calibrating; Data Processing; Thermal Environments

20020069074 National Aerospace Lab., Amsterdam Netherlands

Simulation of Liquid Dynamics Onboard Sloshsat FLEVO

Vreeburg, J. P. B.; Aug. 1999; In English

Report No.(s): PB2002-105870; NLR-TP-99236; No Copyright; Avail: National Technical Information Service (NTIS)

The Sloshsat FLEVO project has an Investigators Working Group which prepared orbital experiments on the behaviour of liquid in spacecraft. These are to be performed with a dedicated small satellite, of about 90 kg empty weight and about 34 kg of water in a 87 litre tank. The spacecraft dynamics are simulated by SMS, the Sloshsat Motion Simulator. SMS predictions and those generated by a computational fluid dynamic (CFD) simulation are compared for an example.

NTIS

Spacecraft Control; Tanks (Containers); Synchronous Meteorological Satellite

20020070372 NASA Marshall Space Flight Center, Huntsville, AL USA

The Implementation of Payload in an Operational Environment

Cissom, R. D., NASA Marshall Space Flight Center, USA; Horvath, Tim J., NASA Marshall Space Flight Center, USA; Watson, Kristi S., Teledyne Brown Engineering, USA; [2002]; 6p; In English; Joint ESA/NASA Spaceflight Safety Conference, 11-14 Jun. 2002, Noordwijk, Netherlands; Sponsored by European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands

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The objective of this paper is to define the safety life-cycle process for a payload beginning with the output of the Payload Safety Review Panel and continuing through the life of the payload on-orbit. It focuses on the processes and products of the operations safety implementation through the increment preparations and real-time operations processes. In addition, the paper addresses the role of the Payload Operations and Integration Center and the interfaces to the International Partner Payload Control Centers.

Author

Payload Control; Safety; Life (Durability)

20020070629 NASA Glenn Research Center, Cleveland, OH USA

An Object Oriented Extensible Architecture for Affordable Aerospace Propulsion Systems

Follen, Gregory J., NASA Glenn Research Center, USA; [2002]; 11p; In English; Applied Vehicle Technology Conference, 22-26 Apr. 2002, Paris, France

Contract(s)/Grant(s): RTOP 704-01-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Driven by a need to explore and develop propulsion systems that exceeded current computing capabilities, NASA Glenn embarked on a novel strategy leading to the development of an architecture that enables propulsion simulations never thought possible before. Full engine 3 Dimensional Computational Fluid Dynamic propulsion system simulations were deemed impossible due to the impracticality of the hardware and software computing systems required. However, with a software paradigm shift and an embracing of parallel and distributed processing, an architecture was designed to meet the needs of future propulsion system modeling. The author suggests that the architecture designed at the NASA Glenn Research Center for propulsion system modeling has potential for impacting the direction of development of affordable weapons systems currently

under consideration by the Applied Vehicle Technology Panel (AVT). This paper discusses the salient features of the NPSS Architecture including its interface layer, object layer, implementation for accessing legacy codes, numerical zooming infrastructure and its computing layer. The computing layer focuses on the use and deployment of these propulsion simulations on parallel and distributed computing platforms which has been the focus of NASA Ames. Additional features of the object oriented architecture that support MultiDisciplinary (MD) Coupling, computer aided design (CAD) access and MD coupling objects will be discussed. Included will be a discussion of the successes, challenges and benefits of implementing this architecture.

Author

Computational Fluid Dynamics; Computer Aided Design; Computer Programs; Propulsion System Configurations; Spacecraft Propulsion

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SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.

20020067732 ATK-Thiokol Propulsion, Brigham City, UT USA

Hybrid Propulsion Testing at Marshall Space Flight Center

Prince, Andrew S., NASA Marshall Space Flight Center, USA; Jul. 09, 2002; 11p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Hybrid propulsion testing involving eleven and twenty-four inch motors performed at the Marshall Space Flight Center (MSFC) from the early 1990's to the present are discussed. Topics covered include: Solid Propulsion Investigation Program, Joint NASA Industry Research and Development (JIRAD) program, Large Subscale Solid Rocket Combustion Simulator (LSSRCS), Hybrid Propulsion Demonstration Program (HPDP), Hybrid Propulsion for Launch Vehicle Booster (HPTLV), Peroxide Hybrid Upper Stage (PHUS) and Solid Fuel Torch (SFT).

CASI

Hybrid Propulsion; Rocket Engines; Test Stands; Motors

20020068094 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

A Comprehensive Investigation of the Role of Vacuum Facility Pressure on High-Power Hall Thruster Testing Final Report, Nov. 2000-Nov 2001

Gallimore, Alec D.; Walker, Mitchell R.; Hofer, Richard R.; Jun. 2002; 61p; In English

Contract(s)/Grant(s): F49620-01-1-0061

Report No.(s): AD-A404124; AFRL-SR-AR-TR-02-0223; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Closed-Drift Hall thrusters (CDTs) have great potential in satisfying many of the spacecraft propulsion needs of the USA Air Force for the next several decades. Its combination of high specific impulse, high thrust efficiency, and high thrust density makes it very attractive for a number of earth-orbit missions. However, due to the wide range of facilities used in CDT testing, it is difficult for researchers to make adequate comparisons between data sets because of both dissimilar instrumentation and backpressures. Thus, a tool is needed that allows researchers to obtain relevant plume data for a variety of chambers and backpressures. To this end, our work for this one-year effort has focused on studying the effectiveness of collimated Faraday probes in obtaining ion current density profiles of CDTs. A collimated probe is attractive because it offers the possibility of obtaining the true ion current density profile regardless of facility pumping speed by filtering low-energy charge-exchange collisions ions from the collector. We compare the ion current density profiles obtained simultaneously with collimated and 'nude' probes one meter from a CDT, at two facility pumping speeds and at thruster power levels between 1.5 and 5.0 kW.

DTIC

Hall Effect; Thrusters; Electric Propulsion

20020068797 Oakwood Coll., Mathematics and Computer Science Dept., Huntsville, AL USA

Advanced Computing Technologies for Rocket Engine Propulsion Systems: Object-Oriented Design with C++

Bekele, Gete, Oakwood Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. V-1 - V-22; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This document explores the use of advanced computer technologies with an emphasis on object-oriented design to be applied in the development of software for a rocket engine to improve vehicle safety and reliability. The primary focus is on phase one of this project, the smart start sequence module. The objectives are: 1) to use current sound software engineering practices, object-orientation; 2) to improve on software development time, maintenance, execution and management; 3) to provide an alternate design choice for control, implementation, and performance.

Derived from text

C++ (Programming Language); Object-Oriented Programming; Rocket Engines; Software Engineering

20020068809 Memphis Univ., Electrical and Computer Engineering Dept., Memphis, TN USA

Magnetized Target Fusion

Griffin, Steven T., Memphis Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XVIII-1 - XVIII-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Magnetized target fusion (MTF) is under consideration as a means of building a low mass, high specific impulse, and high thrust propulsion system for interplanetary travel. This unique combination is the result of the generation of a high temperature plasma by the nuclear fusion process. This plasma can then be deflected by magnetic fields to provide thrust. Fusion is initiated by a small traction of the energy generated in the magnetic coils due to the plasma's compression of the magnetic field. The power gain from a fusion reaction is such that inefficiencies due to thermal neutrons and coil losses can be overcome. Since the fusion reaction products are directly used for propulsion and the power to initiate the reaction is directly obtained from the thrust generation, no massive power supply for energy conversion is required. The result should be a low engine mass, high specific impulse and high thrust system. The key is to successfully initiate fusion as a proof-of-principle for this application. Currently MSFC is implementing MTF proof-of-principle experiments. This involves many technical details and ancillary investigations. Of these, selected pertinent issues include the properties, orientation and timing of the plasma guns and the convergence and interface development of the "pusher" plasma. Computer simulations of the target plasma's behavior under compression and the convergence and mixing of the gun plasma are under investigation. This work is to focus on the gun characterization and development as it relates to plasma initiation and repeatability.

Author

Plasma Propulsion; Fusion Propulsion; Plasma Guns; Controlled Fusion; Targets; High Temperature Plasmas; Magnetic Coils; Magnetic Fields

20020068818 State Univ. of East Tennessee, Dept. of Technology, Johnson City, TN USA

3-D Visualization in Support of Advanced Propulsion

Kyzar, Jan P., State Univ. of East Tennessee, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXVIII-1 - XXVIII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The tools and techniques of three-dimensional computer imaging and animation are more than just a bag of new tricks. They have the power to communicate, inspire, and move the minds of people. Through these animations, it is the intent of the author to help the Propulsion Research Center educate and inspire the public about the vast possibilities of space exploration using Fission Electric Propulsion systems.

Derived from text

Computer Animation; Space Exploration; Education; Presentation

20020068824 Kettering Univ., Dept. of Mechanical Engineering, Flint, MI USA

Multi-Zone Liquid Thrust Chamber Performance Code with Domain Decomposition for Parallel Processing

Navaz, Homayun K., Kettering Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXV-1 - XXXV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Computational Fluid Dynamics (CFD) has considerably evolved in the last decade. There are many computer programs that can perform computations on viscous internal or external flows with chemical reactions. CFD has become a commonly used tool in the design and analysis of gas turbines, ramjet combustors, turbo-machinery, inlet ducts, rocket engines, jet interaction, missile, and ramjet nozzles. One of the problems of interest to NASA has always been the performance prediction for rocket and air-breathing engines. Due to the complexity of flow in these engines it is necessary to resolve the flowfield into a fine mesh to capture quantities like turbulence and heat transfer. However, calculation on a high-resolution grid is associated with a prohibitively increasing computational time that can downgrade the value of the CFD for practical engineering calculations. The

Liquid Thrust Chamber Performance (LTCP) code was developed for NASA/MSFC (Marshall Space Flight Center) to perform liquid rocket engine performance calculations. This code is a 2D/axisymmetric full Navier-Stokes (NS) solver with fully coupled finite rate chemistry and Eulerian treatment of liquid fuel and/or oxidizer droplets. One of the advantages of this code has been the resemblance of its input file to the JANNAF (Joint Army Navy NASA Air Force Interagency Propulsion Committee) standard TDK code, and its automatic grid generation for JANNAF defined combustion chamber wall geometry. These options minimize the learning effort for TDK users, and make the code a good candidate for performing engineering calculations. Although the LTCP code was developed for liquid rocket engines, it is a general-purpose code and has been used for solving many engineering problems. However, the single zone formulation of the LTCP has limited the code to be applicable to problems with complex geometry. Furthermore, the computational time becomes prohibitively large for high-resolution problems with chemistry, two-equation turbulence model, and two-phase flow. To overcome these limitations, the LTCP code is rewritten to include the multi-zone capability with domain decomposition that makes it suitable for parallel processing, i.e., enabling the code to run every zone or sub-domain on a separate processor. This can reduce the run time by a factor of 6 to 8, depending on the problem.

Author

Computational Fluid Dynamics; Liquid Propellant Rocket Engines; Performance Prediction; Parallel Processing (Computers)

20020068838 Vanderbilt Univ., Mechanical Engineering Dept., TN USA

Measuring Rocket Engine Temperatures with Hydrogen Raman Spectroscopy

Wehrmeyer, Joseph A., Vanderbilt Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. LII-1 - LII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Laser-based combustion diagnostics, such as single-pulse UV Raman spectroscopy and visible Raman spectroscopy, have been successfully applied to optically-accessible rocket-like test articles. If an independent pressure measurement is available, Raman major species concentration measurements can also provide a temperature measurement. However it is desirable to obtain a Raman-derived temperature measurement without the need for simultaneous pressure measurement, especially when chamber pressure may vary spatially. This report describes Raman temperature measurements obtained by exploiting the variation in shape of the H₂ Raman spectrum. Hydrogen is advantageous since it is ubiquitous in H₂-O₂ systems and its Raman spectrum is simpler than for other diatomics. However the influence of high pressure on the H₂ Raman spectrum must be investigated. At moderate pressures, well below those of rocket engines, the Raman spectra of O₂ and N₂ are known to become featureless due to collisional broadening.

Author

Temperature Measurement; Raman Spectroscopy; Diatomic Molecules; Hydrogen

20020069015 Thiokol Propulsion, Huntsville, AL USA

Space Shuttle Five-Segment Booster (Short Course)

Graves, Stanley R., Thiokol Propulsion, USA; [2002]; 29p; In English; AIAA RSRM Short Course, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA is considering upgrading the Space Shuttle by adding a fifth segment (FSB) to the current four-segment solid rocket booster. Course materials cover design and engineering issues related to the Reusable Solid Rocket Motor (RSRM) raised by the addition of a fifth segment to the rocket booster. Topics cover include: four segment vs. five segment booster, abort modes, FSB grain design, erosive burning, enhanced propellant burn rate, FSB erosive burning model development and hardware configuration.

CASI

Space Shuttle Boosters; Space Shuttles; Booster Rocket Engines

20020070378 NASA Marshall Space Flight Center, Huntsville, AL USA

Phase 1 Space Fission Propulsion Energy Source Design

Houts, Mike, NASA Marshall Space Flight Center, USA; VanDyke, Melissa, NASA Marshall Space Flight Center, USA; Godfroy, Tom, NASA Marshall Space Flight Center, USA; Pedersen, Kevin, NASA Marshall Space Flight Center, USA; Martin, James, NASA Marshall Space Flight Center, USA; Dickens, Ricky, Microcraft, Inc., USA; Salvail, Pat, NASA Marshall Space Flight Center, USA; Hrbud, Ivana, NASA Marshall Space Flight Center, USA; Carter, Robert, NASA Marshall Space Flight Center, USA; [2002]; 11p; In English; 2002 American Nuclear Society Meeting: International Congress on Advanced Nuclear Power Plants, 9-13 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fission technology can enable rapid, affordable access to any point in the solar system. If fission propulsion systems are to be developed to their full potential; however, near-term customers must be identified and initial fission systems successfully developed, launched, and operated. Studies conducted in fiscal year 2001 (IISTP, 2001) show that fission electric propulsion (FEP) systems with a specific mass at or below 50 kg/kWjet could enhance or enable numerous robotic outer solar system missions of interest. At the required specific mass, it is possible to develop safe, affordable systems that meet mission requirements. To help select the system design to pursue, eight evaluation criteria were identified: system integration, safety, reliability, testability, specific mass, cost, schedule, and programmatic risk. A top-level comparison of four potential concepts was performed: a Testable, Passive, Redundant Reactor (TPRR), a Testable Multi-Cell In-Core Thermionic Reactor (TMCT), a Direct Gas Cooled Reactor (DGCR), and a Pumped Liquid Metal Reactor (PLMR). Development of any of the four systems appears feasible. However, for power levels up to at least 500 kWt (enabling electric power levels of 125-175 kWe, given 25-35% power conversion efficiency) the TPRR has advantages related to several criteria and is competitive with respect to all. Hardware-based research and development has further increased confidence in the TPRR approach. Successful development and utilization of a "Phase I" fission electric propulsion system will enable advanced Phase 2 and Phase 3 systems capable of providing rapid, affordable access to any point in the solar system.

Author

Space Power Reactors; Electric Propulsion; Mission Planning; Systems Integration

20020070541 NASA Glenn Research Center, Cleveland, OH USA

Battery Reinitialization of the Photovoltaic Module of the International Space Station

Hajela, Gyan, Boeing Co., USA; Cohen, Fred, Boeing Co., USA; Dalton, Penni, NASA Glenn Research Center, USA; July 2002; 11p; In English; 37th Intersociety Energy Conversion Engineering Conference, 28 Jul. - 2 Aug. 2002, Washington, DC, USA; Sponsored by Electron Devices Society, USA

Contract(s)/Grant(s): RTOP 478-29-10

Report No.(s): NASA/TM-2002-211713; E-13464; NAS 1.15:211713; IECEC-2002-20033; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The photovoltaic (PV) module on the International Space Station (ISS) has been operating since November 2000 and supporting electric power demands of the ISS and its crew of three. The PV module contains photovoltaic arrays that convert solar energy to electrical power and an integrated equipment assembly (IEA) that houses electrical hardware and batteries for electric power regulation and storage. Each PV module contains two independent power channels for fault tolerance. Each power channel contains three batteries in parallel to meet its performance requirements and for fault tolerance. Each battery consists of 76 Ni-Hydrogen (Ni-H₂) cells in series. These 76 cells are contained in two orbital replaceable units (ORU) that are connected in series. On-orbit data are monitored and trended to ensure that all hardware is operating normally. Review of on-orbit data showed that while five batteries are operating very well, one is showing signs of mismatched ORUs. The cell pressure in the two ORUs differs by an amount that exceeds the recommended range. The reason for this abnormal behavior may be that the two ORUs have different use history. An assessment was performed and it was determined that capacity of this battery would be limited by the lower pressure ORU. Steps are being taken to reduce this pressure differential before battery capacity drops to the point of affecting its ability to meet performance requirements. As a first step, a battery reinitialization procedure was developed to reduce this pressure differential. The procedure was successfully carried out on-orbit and the pressure differential was reduced to the recommended range. This paper describes the battery performance and the consequences of mismatched ORUs that make a battery. The paper also describes the reinitialization procedure, how it was performed on orbit, and battery performance after the reinitialization. On-orbit data monitoring and trending is an ongoing activity and it will continue as ISS assembly progresses.

Author

Photovoltaic Cells; Solar Energy; Fault Tolerance

20020070608 NASA Glenn Research Center, Cleveland, OH USA

International Space Station Nickel-Hydrogen Battery On-Orbit Performance

Dalton, Penni, NASA Glenn Research Center, USA; Cohen, Fred, Boeing Co., USA; July 2002; 11p; In English; 37th Intersociety Energy Conversion Engineering Conference, 28 Jul. - 2 Aug. 2002, Washington, DC, USA; Sponsored by Electron Devices Society, USA

Contract(s)/Grant(s): RTOP 478-29-10

Report No.(s): NASA/TM-2002-211721; E-13472; NAS 1.15:211721; IECEC-2002-20091; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

International Space Station (ISS) Electric Power System (EPS) utilizes Nickel-Hydrogen (Ni-H₂) batteries as part of its power system to store electrical energy. The batteries are charged during insolation and discharged during eclipse. The batteries

are designed to operate at a 35 percent depth of discharge (DOD) maximum during normal operation. Thirty-eight individual pressure vessel (IPV) Ni-H₂ battery cells are series-connected and packaged in an Orbital Replacement Unit (ORU). Two ORUs are series-connected utilizing a total of 76 cells to form one battery. The ISS is the first application for low earth orbit (LEO) cycling of this quantity of series-connected cells. The P6 (Port) Integrated Equipment Assembly (IEA) containing the initial ISS high-power components was successfully launched on November 30, 2000. The IEA contains 12 Battery Subassembly ORUs (6 batteries) that provide station power during eclipse periods. This paper will discuss the battery performance data after eighteen months of cycling.

Author

Nickel Hydrogen Batteries; Space Station Power Supplies; Pressure Vessels

20020070612 NASA Glenn Research Center, Cleveland, OH USA

Validation of International Space Station Electrical Performance Model Via On-Orbit Telemetry

Jannette, Anthony G., Analox Corp., USA; Hojnicki, Jeffrey S., NASA Glenn Research Center, USA; McKissock, David B., NASA Glenn Research Center, USA; Fincannon, James, NASA Glenn Research Center, USA; Kerslake, Thomas W., NASA Glenn Research Center, USA; Rodriguez, Carlos D., NASA Glenn Research Center, USA; July 2002; 11p; In English; 37th Intersociety Energy Conversion Engineering Conference, 28 Jul. - 2 Aug. 2002, Washington, DC, USA; Sponsored by Electron Devices Society, USA

Contract(s)/Grant(s): RTOP 575-15-69

Report No.(s): NASA/TM-2002-211803; E-13498; NAS 1.15:211803; IECEC-2002-20007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first U.S. power module on International Space Station (ISS) was activated in December 2000. Comprised of solar arrays, nickel-hydrogen (NiH₂) batteries, and a direct current power management and distribution (PMAD) system, the electric power system (EPS) supplies power to housekeeping and user electrical loads. Modeling EPS performance is needed for several reasons, but primarily to assess near-term planned and off-nominal operations and because the EPS configuration changes over the life of the ISS. The System Power Analysis for Capability Evaluation (SPACE) computer code is used to assess the ISS EPS performance. This paper describes the process of validating the SPACE EPS model via ISS on-orbit telemetry. To accomplish this goal, telemetry was first used to correct assumptions and component models in SPACE. Then on-orbit data was directly input to SPACE to facilitate comparing model predictions to telemetry. It will be shown that SPACE accurately predicts on-orbit component and system performance. For example, battery state-of-charge was predicted to within 0.6 percentage points over a 0 to 100 percent scale and solar array current was predicted to within a root mean square (RMS) error of 5.1 Amps out of a typical maximum of 220 Amps. First, SPACE model predictions are compared to telemetry for the ISS EPS components: solar arrays, NiH₂ batteries, and the PMAD system. Second, SPACE predictions for the overall performance of the ISS EPS are compared to telemetry and again demonstrate model accuracy.

Author

Systems Analysis; Performance Prediction; Nickel Hydrogen Batteries; Electrical Properties; Electric Power Supplies

20020070615 NASA Glenn Research Center, Cleveland, OH USA

A Systems Model for Power Technology Assessment

Hoffman, David J., NASA Glenn Research Center, USA; July 2002; 11p; In English; 37th Intersociety Energy Conversion Engineering Conference, 28 Jul. - 2 Aug. 2002, Washington, DC, USA; Sponsored by Electron Devices Society, USA

Contract(s)/Grant(s): RTOP 755-1A-16

Report No.(s): NASA/TM-2002-211728; E-13482; NAS 1.15:211728; IECEC-2002-20038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computer model is under continuing development at NASA Glenn Research Center that enables first-order assessments of space power technology. The model, an evolution of NASA Glenn's Array Design Assessment Model (ADAM), is an Excel workbook that consists of numerous spreadsheets containing power technology performance data and sizing algorithms. Underlying the model is a number of databases that contain default values for various power generation, energy storage and power management and distribution component parameters. These databases are actively maintained by a team of systems analysts so that they contain state-of-art data as well as the most recent technology performance projections. Sizing of the power subsystems can be accomplished either by using an assumed mass specific power (W/kg) or energy (Wh/kg) or by a bottoms-up calculation that accounts for individual component performance and masses. The power generation, energy storage and power management and distribution subsystems are sized for given mission requirements for a baseline case and up to three alternatives. This allows four different power systems to be sized and compared using consistent assumptions and sizing algorithms. The component sizing models contained in the workbook are modular so that they can be easily maintained and updated. All significant input values

have default values loaded from the databases that can be over-written by the user. The default data and sizing algorithms for each of the power subsystems are described in some detail. The user interface and workbook navigational features are also discussed. Finally, an example study case that illustrates the model's capability is presented.

Author

Computerized Simulation; Spreadsheets; Spacecraft Models; Electric Power Supplies; Performance Prediction

23

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

20020067759 Virginia Univ., Charlottesville, VA USA

The Role of Coating Defects and Substrate Heterogeneities in the Long-Term Performance of Painted Aluminum Alloys
Final Report, 1 Dec. 1998-28 Feb. 2002

Taylor, S. R.; Kelly, R. G.; Scully, J. R.; Apr. 2002; 243p; In English

Contract(s)/Grant(s): F49620-99-1-0060; Proj-2303

Report No.(s): AD-A403785; FAS-5-25889; AFRL-SR-AR-TR-02-0228; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This project seeks to understand the material, environmental, and interfacial factors that control the initiation and propagation of underpaint corrosion on aerospace aluminum alloys. The information needed to understand coating breakdown requires the use of local electrochemical, optical, and chemical methods. These methods have shown that intrinsic chemical heterogeneities most likely exist in the epoxy coating materials. These defects allow water and ions to the metal interface. The type and extent of subsequent underfilm corrosion is then determined by the type and possibly spacing of intermetallic compounds, as well as the ionic and material gating characteristics of the coating material.

DTIC

Aluminum Alloys; Substrates; Coating

20020068026 Rochester Univ., Dept. of Chemistry, NY USA

The Photo-Oxidation of Biacetyl at 4358 A

Padnos, Norman; Jan. 1963; 82p; In English

Report No.(s): AD-A403888; AFOSR-5123; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this work is to determine whether the quenching of biacetyl phosphorescence by oxygen is due to a chemical reaction between the excited biacetyl and the oxygen, or to a physical quenching process. In order to determine this, the photolysis of gaseous biacetyl-oxygen mixtures has been studied at 4358 A and room temperature. The products identified were carbon dioxide, carbon monoxide, water, methanol and formaldehyde. The quantum yields of carbon dioxide and carbon monoxide formation and oxygen consumption were determined. The carbon dioxide and oxygen quantum yields are independent of absorbed intensity over the range studied, $10(\text{exp } 11) - 10(\text{exp } 13)$ quanta/cu cm second. The carbon monoxide yields may decrease with increasing intensity, but this is not certain because of the large scatter in the yields. The yields increase with oxygen pressure at oxygen pressures less than about 0.1 mm. and reach limiting values at higher oxygen pressures. The variation of carbon dioxide formation and oxygen consumption with oxygen pressure correlates fairly well with the variation of phosphorescence with oxygen pressure. The significance of this correlation is somewhat doubtful, because of a lack of knowledge of the secondary reactions in the system. A short chain process probably predominates.

DTIC

Phosphorescence; Photooxidation; Acetyl Compounds

20020068897 Department of the Navy, Washington, DC USA

Non-Chromate Conversion Coatings

Tucker, Wayne C., Inventor; Medeiros, Maria G., Inventor; Brown, Richard, Inventor; Jul. 19, 2002; 13p; In English

Patent Info.: Filed 7 May 2002; US-Patent-Appl-SN-10143176

Report No.(s): AD-D020031; No Copyright; Avail: Defense Technical Information Center (DTIC)

A non-chromate conversion coating and method of applying same wherein the coating comprises a titanate, such as potassium titanate or sodium metatitanate, as a "drop-in replacement" for a chromate in an otherwise chromate-containing conversion coating.

DTIC

Patent Applications; Protective Coatings; Potassium; Titanates; Sodium

20020069109 National Inst. of Standards and Technology, Gaithersburg, MD USA

Celebrating One Hundred Years of Chemistry at the National Institute of Standards and Technology. Chemical Science and Technology Laboratory

Semerjian, H. G.; Koch, W. F.; Beary, E. S.; Epstein, M. S.; Vasquez, G. B.; Mar. 2001; 96p; In English

Report No.(s): PB2002-107965; NISTIR-6388-2001-ED; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Since its creation in 1901, the National Institute of Standards and Technology has been the source of measurements and standards on which U.S. manufacturing, commerce, scientific institutions and all branches and levels of government depend. NIST will celebrate its centennial on March 3, 2001. Chartered by Congress, NIST (originally known as the National Bureau of Standards) was the first physical science research laboratory of the federal government. The Chemical Science and Technology Laboratory (CSTL) is one of NIST's seven Measurements and Standards Laboratories. Reflecting the importance of chemical and chemical engineering measurements and standards to the rapid industrialization of the U.S., the Chemistry Division and the Heat and Thermometry Division were among the first established by the founders of NBS/NIST in 1901. Building on a one hundred year history of technical excellence, today's Chemical Science and Technology Laboratory has the most comprehensive array of chemical, physical and engineering measurement capabilities of any group working in chemical science and technology. The report presents an overview of the CSTL.

NTIS

Chemical Analysis; Chemical Engineering; Chemical Reactions; Temperature Measurement

20020070561 NASA Glenn Research Center, Cleveland, OH USA

Lead Removal From Synthetic Leachate Matrices by a Novel Ion-Exchange Material

Street, Kenneth W., Jr., NASA Glenn Research Center, USA; Hovanitz, Edward S., Engelhard Corp., USA; Chi, Sulan, Lilly (Eli) and Co., USA; July 2002; 19p; In English

Contract(s)/Grant(s): DW80936188-01-0

Report No.(s): NASA/TM-2002-211090; NAS 1.15:211090; E-12932-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses the application of a novel polyacrylate-based ion-exchange material (IEM) for the removal of lead (Pb) ions from water. Preliminary testing includes the establishment of the operating pH range, capacity information, and the effect of calcium and anions in the matrix. Batch testing with powder indicates slightly different optimal operational conditions from those used for column testing. The ion exchanger is excellent for removing lead from aqueous solutions.

Author

Lead (Metal); Metal Ions; Acrylic Resins; Ion Exchange Resins; Aqueous Solutions

20020070606 NASA Glenn Research Center, Cleveland, OH USA

Surface Characterization Techniques: An Overview

Miyoshi, Kazuhisa, NASA Glenn Research Center, USA; July 2002; 52p; In English

Contract(s)/Grant(s): RTOP 708-31-13

Report No.(s): NASA/TM-2002-211497; E-12968; NAS 1.15:211497; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To understand the benefits that surface modifications provide, and ultimately to devise better ones, it is necessary to study the physical, mechanical, and chemical changes they cause. This chapter surveys classical and leading-edge developments in surface structure and property characterization methodologies. The primary emphases are on the use of these techniques as they relate to surface modifications, thin films and coatings, and tribological engineering surfaces and on the implications rather than the instrumentation.

Author

Thin Films; Tribology; Surface Properties; Chemical Properties; Mechanical Properties

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20020067711 Building and Construction Research TNO, Centre for Maritime Engineering, Delft, Netherlands

Calculations and Experiments on COVOCO Panels Interim Report

vandenEikhoff, J., Building and Construction Research TNO, Netherlands; Apr. 29, 2002; 64p; In English; Original contains color illustrations

Contract(s)/Grant(s): A00KM134/13714; TNO Proj. 006.13678

Report No.(s): TD-2001-0222; Rept-2001-CMC-R142; Copyright; Avail: Issuing Activity

New possibilities for sensor performance and signature reduction lead towards composite superstructures c.q. masts. Specifications are formulated for the mast and sandwich panels. A design study has been done for construction methods of a modular mast. From the construction principles one mast concept is selected: a 'space-frame' in which sandwich panels play the following roles: protection, electromagnetic shielding and shear stiffness for the mast. The sandwich panels are relatively simple made according to a system of standard sizes. A number of test panels are produced and shock loaded. Calculations are reported, performed with the failure prediction model developed in Dycoss. Also, the results of shock tests on the connected panels are discussed. The integrated mast design has been tested in small scale and seems to perform well and it can be used for future designs. The production seems to be rather critical and must be reconsidered. Shock calculations indicate start of failure at comparable displacements as found in the experiments. The software needs data for the bond material, which were not available, so estimated values had to be used. It is recommended that the bond material data will be determined.

Author

Shock Tests; Failure Analysis; Sandwich Structures; Panels; Composite Structures; Computation; Experimentation; Design Analysis

20020067753 Minnesota Univ., Dept. of Chemical Engineering and Materials Science, Minneapolis, MN USA

Block Copolymer-Based Thermoset Nanocomposites Final Report

Bates, Frank S.; Feb. 2002; 13p; In English

Contract(s)/Grant(s): F49620-99-1-0028; AF Proj. 2303

Report No.(s): AD-A403744; AFRL-SR-AR-TR-02-0227; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Amphiphilic block copolymers have been added to two-part epoxy resin and cured leading to well-defined nanocomposites. Reactive and non-reactive polar blocks were coupled to non-polar hydrocarbon blocks using anionic and living free-radical polymerization techniques. Mixtures containing 0 to 100% block copolymer were investigated for structure by small-angle X-ray scattering and transmission electron microscopy, and for mechanical properties by compact tension testing. Spherical micelles and vesicles were documented at low block concentrations, and these nanocomposites exhibit enhanced fracture toughness. Chemical bond formation between the matrix and block copolymer leads to some improvement in toughness.

DTIC

Block Copolymers; Mechanical Properties; Nanocomposites; Polymerization; Free Radicals

20020067793 Tuskegee Inst., AL USA

Damage Tolerance of Resin Transfer Molded Composite Sandwich Constructions Final Report, 24 Apr. 1996-23 Apr 1999

Vaidya, U. K.; Mahfuz, H.; Jeelani, S.; May 1999; 408p; In English

Contract(s)/Grant(s): F33615-96-C-3200; Proj-2401

Report No.(s): AD-A404008; TCAM-WL-99-02; AFRL-VA-WP-TR-1999-3053; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The objectives of this program were to investigate several innovative sandwich constructions developed by affordable manufacturing process for their impact damage resistance/tolerance. The sandwich composite concepts considered in this study possessed the feasibility to improve the transverse stiffness, provide enhanced damage resistance/tolerance to impact and functionality advantages in comparison to those made from conventional honeycomb and foam cores. The core concepts considered included traditional foam, titanium, steel and E-glass/epoxy pins-reinforced foam, hollow truss/pin core, foam-filled-honeycomb cores, and honeycomb core with hybrid facesheets. Graphite and glass fabric and prepreg facesheets were considered. A number of low cost manufacturing techniques to produce panels included; resin transfer molding (RTM), vacuum assisted resin infusion/transfer molding (VARTM), co-injection VARTM and vacuum assisted compression molding (VACM). Detailed experimental impact studies were performed under three scenarios low velocity, intermediate velocity, and high strain rate loading. Supporting analysis and finite element modeling work were conducted. The various tests and analysis conducted

revealed that in terms of failure characteristics, the RTM/VARTM processed sandwich composites yielded similar performance as those manufactured from traditional techniques such as vacuum assisted compression molding. The reinforcement of foam core with stiff pins and/or honeycomb cells was found to provide attractive benefits to suppress/contain damage under low velocity, intermediate velocity and due to high strain rate impact scenarios.

DTIC

Manufacturing; Resin Transfer Molding; Damage; Glass Fiber Reinforced Plastics; Honeycomb Structures; Sandwich Structures

20020068804 Southern Univ., Dept. of Mechanical Engineering, LA USA

Investigation of Friction Stir Welding and Laser Engineered Net Shaping of Metal Matrix Composite Materials

Diwan, Ravinder M., Southern Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XII-1 - XII-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The improvement in weld quality by the friction stir welding (FSW) process invented by TWI of Cambridge, England, patented in 1991, has prompted investigation of this process for advanced structural materials including Al metal matrix composite (Al-MMC) materials. Such materials can have high specific stiffness and other potential beneficial properties for the extreme environments in space. Developments of discontinuous reinforced Al-MMCs have found potential space applications and the future for such applications is quite promising. The space industry has recognized advantages of the FSW process over conventional welding processes such as the absence of a melt zone, reduced distortion, elimination of the need for shielding gases, and ease of automation. The process has been well proven for aluminum alloys, and work is being carried out for ferrous materials, magnesium alloys and copper alloys. Development work in the FSW welding process for joining of Al-MMCs is relatively recent and some of this and related work can be found in referenced research publications. NASA engineers have undertaken to spear head this research development work for FSW process investigation of Al-MMCs. Some of the reported related work has pointed out the difficulty in fusion welding of particulate reinforced MMCs where liquid Al will react with SiC to precipitate aluminum carbide (Al₄C₃). Advantages of no such reaction and no need for joint preparation for the FSW process is anticipated in the welding of Al-MMCs. The FSW process has been best described as a combination of extrusion and forging of metals. This is carried out as the pin tool rotates and is slowly plunged into the bond line of the joint as the pin tool's shoulder is in intimate contact with the work piece. The material is friction-stirred into a quality weld. Al-MMCs, 4 in. x 12 in. plates of 0.25 in. (6.35mm) thickness, procured from MMCC, Inc. were butt welded using FSW process at Marshall Space Flight Center (MSFC) using prior set of operating conditions. Weld quality was evaluated using radiography and standard metallography techniques. Another aspect of the MMCs centered around the use of the laser engineered net shaping (LENS) processing of selected Narloy-Z composites. Such an approach has been earlier studied for fabrication of stainless steels. In the present study, attempts were made to fabricate straight cylindrical specimens using LENS process of Narloy-Z and Narloy-Z with 20 vol. % Al₂O₃ MMCs using the direct metal deposition Optomec LENS-750 system.

Derived from text

Friction Welding; Metal Matrix Composites; Weld Strength; Laser Machining; Metal Working; Aluminum; Aerospace Engineering

20020070505 QSS Group, Inc., Cleveland, OH USA

Robust Joining and Assembly Technologies for Ceramic Matrix Composites: Technical Challenges and Opportunities

Mrityunjay, Singh, QSS Group, Inc., USA; [2002]; 23p; In English; International Symposium on SiC/SiC Composite Materials R and D and Its Application to Advanced Energy Systems, 20-22 May 2002, Kyoto, Japan; Sponsored by Kyoto Univ., Japan; Meeting sponsored in part by CREST

Contract(s)/Grant(s): NAS3-00145; RTOP 708-73-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fiber reinforced ceramic matrix composites are under active consideration for use in a wide variety of high temperature applications within the aeronautics, energy, process, and nuclear industries. The engineering designs require fabrication and manufacturing of complex shaped parts. In many instances, it is more economical to build up complex shapes by Joining simple geometrical shapes. Thus, joining and attachment have been recognized as enabling technologies for successful utilization of ceramic components in various demanding applications. In this presentation, various challenges and opportunities in design, fabrication, and testing of high temperature joints in ceramic matrix composites will be presented. Various joint design philosophies and design issues in joining of composites will be discussed along with an affordable, robust ceramic joining technology (ARCJoinT). A wide variety of ceramic composites, in different shapes and sizes, have been joined using this

technology. Microstructure and mechanical properties of joints will be reported. Current status of various ceramic joining technologies and future prospects for their applications will also be discussed.

Author

Ceramic Matrix Composites; Reinforcement (Structures); Fiber Composites; Mechanical Properties; Manufacturing

20020070569 NASA Glenn Research Center, Cleveland, OH USA

Effect of Environment on Fatigue Behavior of a Nicalon(TM)/Si-N-C Ceramic Matrix Composite

Kalluri, Sreeramesh, Ohio Aerospace Inst., USA; Ojard, Greg C., United Technologies Corp., USA; Verrilli, Michael J., NASA Glenn Research Center, USA; [2002]; 8p; In English; 26th Annual International Conference on Advanced Ceramics and Composites, 13-18 Jan. 2002, Cocoa Beach, FL, USA; Sponsored by American Ceramic Society, USA

Contract(s)/Grant(s): RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The effect of environmental exposure on the fatigue life of Nicalon(TM) /Si-N-C composite was investigated in this study. Test specimens with arrays of 1.8 mm diameter holes and two different open areas, 25 and 35%, were machined. Three environmental conditions were studied: 1) continuous fatigue cycling in air, 2) fatigue cycling in air alternating with humidity exposure, and 3) fatigue cycling in air alternating with exposure to a salt-fog environment. All fatigue testing on specimens with holes was performed with a load ratio, $R = 0.05$, and at a temperature of 910 C. In general, fatigue lives were shortest for specimens subjected to salt-fog exposure and longest for specimens subjected to continuous fatigue cycling in air. The fatigue data generated on the specimens with holes were compared with fatigue data generated in air on specimens with no holes. Fatigue strength reduction factors for different environmental conditions and open areas investigated in the study were calculated for the Nicalon(TM) /Si-N-C composite.

Author

Ceramic Matrix Composites; Fatigue Tests; Environmental Tests

20020070596 Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

Engineering Method for Prediction of Impact Response and Damage in Sandwich Panels

Olsson, R.; Jun. 2001; 58p

Report No.(s): PB2002-105012; FOI-R-0136-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An engineering method is suggested for prediction of impact response and damage of flat sandwich panels. The approach accounts for local core crushing, delamination and large face sheet deflections and does not rely on empirical indentation laws. Different models are suggested depending upon the impactor mass being either larger or significantly smaller than the mass of the impacted panel. The solution for large mass impact is based on closed form expressions. The solution for small mass impact is obtained from a dimensionless two-parameter integral equation. The validity of the approach is demonstrated on a number of static indentation experiments and impacts on sandwich panels.

NTIS

Composite Materials; Structural Engineering; Impact Resistance

20020070614 NASA Glenn Research Center, Cleveland, OH USA

The Role of Ceramics and Ceramic Matrix Composites in NASA's Advanced Space Propulsion Programs

Eckel, Andrew J., NASA Glenn Research Center, USA; [2002]; 26p; In English; Propulsion for Space Transportation of the XXIst Century, 14-18 May 2002, Versailles, France

Contract(s)/Grant(s): RTOP 708-73-26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, NASA has embarked on several new and exciting efforts in the exploration and use of space. The successful accomplishment of many planned missions and projects is dependent upon the development and deployment of previously unproven propulsion systems. Key to many of the propulsion systems is the use of structural ceramics and ceramic matrix composites. In spite of their promise, a number of programmatic and technical hurdles remain before the potential of ceramic materials can be realized. A programmatic environment which focuses on relatively short term hardware demonstration programs precludes traditional longer term material's development efforts. The challenge oftentimes becomes one of engineering ceramics into proposed missions. This is dependent upon a fundamental understanding of processing, degradation and design issues unique to space vehicle design and operations. A review of the general missions and benefits of utilizing ceramics and ceramic matrix composites will be presented. The design parameters and operating conditions will be presented for both specific missions/vehicles and classes of components. Key technical challenges and opportunities are identified along with suggested paths for addressing them.

Author

Ceramic Matrix Composites; Degradation; Design Analysis; Technology Utilization

20020070657 Aerospace Corp., El Segundo, CA USA

Flywheel Rotor Safe-Life Technology Final Report

Ratner, J. K. H., Aerospace Corp., USA; Chang, J. B., Aerospace Corp., USA; Christopher, D. A., Aerospace Corp., USA; July 2002; 273p; In English; Original contains color illustrations

Contract(s)/Grant(s): F04701-00-C-0009; RTOP 755-1A-09

Report No.(s): NASA/CR-2002-211810; NAS 1.26:211810; E-13506; TOR-2002(2140)-1; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Since the 1960s, research has been conducted into the use of flywheels as energy storage systems. The-proposed applications include energy storage for hybrid and electric automobiles, attitude control and energy storage for satellites, and uninterruptible power supplies for hospitals and computer centers. For many years, however, the use of flywheels for space applications was restricted by the total weight of a system employing a metal rotor. With recent technological advances in the manufacturing of composite materials, however, lightweight composite rotors have begun to be proposed for such applications. Flywheels with composite rotors provide much higher power and energy storage capabilities than conventional chemical batteries. However, the failure of a high speed flywheel rotor could be a catastrophic event. For this reason, flywheel rotors are classified by the NASA Fracture Control Requirements Standard as fracture critical parts. Currently, there is no industry standard to certify a composite rotor for safe and reliable operation forth(required lifetime of the flywheel. Technical problems hindering the development of this standard include composite manufacturing inconsistencies, insufficient nondestructive evaluation (NDE) techniques for detecting defects and/or impact damage, lack of standard material test methods for characterizing composite rotor design allowables, and no unified proof (over-spin) test for flight rotors. As part of a flywheel rotor safe-life certification pro-ram funded b the government, a review of the state of the art in composite rotors is in progress. The goal of the review is to provide a clear picture of composite flywheel rotor technologies. The literature review has concentrated on the following topics concerning composites and composite rotors: durability (fatigue) and damage tolerance (safe-life) analysis/test methods, in-service NDE and health monitoring techniques, spin test methods/ procedures, and containment options. This report presents the papers selected for their relevance to this topic and summarizes them.

Author

Energy Storage; Technology Utilization; Manufacturing; Industries; Flywheels

20020070674 Pennsylvania Transportation Inst., University Park, PA USA

Composites in Bridges Final Report, 29 Jan. 2001 - 28 2002

Elgaaly, M.; Mar. 19, 2002; 36p; In English

Report No.(s): PB2002-106766; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Glass has been the predominant fiber in use because of an economical balance of cost and strength. Glass fibers are elastic until failure and exhibit negligible creep under controlled, dry conditions. E-glass comprises approximately 80 to 90 percent of the glass fiber commercial production. Polyester and vinyl ester are the resins most commonly used in Civil Structural applications; Epoxy resins are used in aircraft, aerospace, and defense applications. Fiber reinforced plastic (FRP) products are available in bars, meshes, two and three dimensional grids, and structural shapes similar to steel. Most of the products are produced by pultrusion. Civil Structural Engineering applications of FRP have increased over the past few years. This is due to a high strength-to-weight ratio, high resistance to chemical attacks, low electric conductivity, vibration damping, high resistance to fatigue, low coefficient of thermal expansion, and most importantly tailored ability. Lack of communication between the composites and the construction industries resulted in a delay in the development of composites as building construction material. Unfortunately, companies in the composite industry have independently developed competitive products rather than working together to develop a large market. Moreover, they have not become involved in developing standards and specifications.

NTIS

Composite Structures; Structural Engineering; Fiber Composites

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.

20020067734 NASA Marshall Space Flight Center, Huntsville, AL USA

A Novel Method for Electroplating Ultra-High-Strength Glassy Metals

Ramsey, Brian, NASA Marshall Space Flight Center, USA; Engelhaupt, Darell, Alabama Univ., USA; [2002]; 1p; In English; NASA Advanced Materials Symposium, 30-31 May 2002, Cleveland, OH, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A novel method for electroplating ultra-high-strength glassy metals, nickel-phosphorous and nickel-cobalt-phosphorous, has been developed at NASA Marshall Space Flight Center, cooperatively with the University of Alabama in Huntsville. Traditionally, thin coatings of these metals are achieved via electroless deposition. Benefits of the new electrolytic process include thick, low-stress deposits, free standing shapes, lower plating temperature, low maintenance, and safer operation with substantially lower cost.

Author

Electroplating; Metallic Glasses; Metal Coatings; High Strength

20020067800 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Identification of Toxins: MALDI and Electrospray Mass Spectrometry of Botulinum Toxins Type A and B Final Report
Identificatie Van Toxinen Massaspectromrie Van Botuline Toxinen A en B

vanBaar, B. L. M., Prins Maurits Lab. TNO, Netherlands; Hulst, A. G., Prins Maurits Lab. TNO, Netherlands; deJong, A. L., Prins Maurits Lab. TNO, Netherlands; Wils, E. R. J., Prins Maurits Lab. TNO, Netherlands; May 2002; 100p; In English; Original contains color illustrations

Contract(s)/Grant(s): A93/KL/424; TNO Proj. 014.12826

Report No.(s): TD-2002-0028; PML-2002-A28; Copyright; Avail: Issuing Activity

A method earlier developed for the mass spectrometric (MS) identification of tetanus toxin (TTX) was applied to botulinum toxins type A and B (BTXA and BTXB). Botulinum toxins are extremely neurotoxic bacterial toxins, likely to be used as biological warfare agent. Biologically active BTXA and BTXB are comprised of a protein complex of the respective neurotoxins with specific haemagglutinins (HA) and non-toxic non-haemagglutinins (NTNH). These protein complexes are also seen in mass spectrometric identification. The particular BTXA complex, from C botulinum strain 62A, almost completely matched database data derived from genetic sequences known for this strain. Although no such database information was available for BTXB, from C. botulinum strain okra, all protein sequences from the complex except that of HA-70 were found to match proteins known from other type B strains. It was found that matrix-assisted laser desorption/ionisation (MALDI) MS provides provisional identification from trypsin digest peptide maps and that liquid chromatography electrospray (tandem) mass spectrometry affords unequivocal identification from amino acid sequence information.

Author

Clostridium Botulinum; Peptides; Amino Acids; Genetic Code; Toxins and Antitoxins; Proteins; Detection

20020068081 Bell Aerospace Co., Buffalo, NY USA

High Speed Turbulent Mixing and Combustion Interim Report

Morgenthaler, J. H.; Zelazny, S. W.; Rudinger, G.; Dec. 1972; 149p; In English

Contract(s)/Grant(s): F44620-70-C-0116; AF Proj. 9711-02

Report No.(s): AD-A403889; BAC-9500-920258; AFOSR-TR-73-1051; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Advanced hypersonic air-breathing and hybrid engines utilizing subsonic/ supersonic combustion, and high energy lasers, are required for effective weapon systems in future aerospace missions. The overall objective of this program is to investigate the turbulent mixing and combustion processes required for these advanced systems. Results of these studies will assist in engineering design and development of practical injection-mixing systems and combustion chambers for the advanced propulsion systems, as well as providing critical design input for development and optimization of high energy chemical lasers. The following theoretical one experimental studies for homogeneous and heterogeneous highspeed turbulent mixing and combustion in subsonic and supersonic streams are reported. (1) An analytical study of turbulent reacting flows with mass, momentum, and energy transfer. (2) Experimental and analytical study of gas-particle, turbulent mixing and reacting flow with non-tangential particle

injection. (3) Analysis of injection of non-homogeneous and heterogeneous fuels into uniform supersonic and subsonic streams, and (4) A review of existing experimental data and analytical methods, concerning turbulent mixing and combustion. Objectives of this research are to: (1) Determine effects of chemical reaction, mass, momentum, and energy transport on flow field development of coaxial jets and ducted flows. (2) Develop necessary analytical tools for predicting gas-particle mixing and combustor flow systems. (3) Investigate scaling parameters, pressure gradient shock losses, and initial jet penetration versus downstream turbulent diffusion for the transverse mode of injection, and (4) Determine the adequacy and applicability of existing two-stream mixing data and analytical techniques.

DTIC

Turbulent Flow; Combustion; Turbulent Mixing; Injection; Combustible Flow; Air Breathing Engines

20020068802 Spelman Coll., Chemistry Dept., Atlanta, GA USA

Semiclassical Calculation of Reaction Rate Constants for Homolytical Dissociations

Cardelino, Beatriz H., Spelman Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. X-1 - X-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

There is growing interest in extending organometallic chemical vapor deposition (OMCVD) to III-V materials that exhibit large thermal decomposition at their optimum growth temperature, such as indium nitride. The group III nitrides are candidate materials for light-emitting diodes and semiconductor lasers operating into the blue and ultraviolet regions. To overcome decomposition of the deposited compound, the reaction must be conducted at high pressures, which causes problems of uniformity. Microgravity may provide the venue for maintaining conditions of laminar flow under high pressure. Since the selection of optimized parameters becomes crucial when performing experiments in microgravity, efforts are presently geared to the development of computational OMCVD models that will couple the reactor fluid dynamics with its chemical kinetics. In the present study, we developed a method to calculate reaction rate constants for the homolytic dissociation of III-V compounds for modeling OMCVD. The method is validated by comparing calculations with experimental reaction rate constants.

Derived from text

Metalorganic Chemical Vapor Deposition; Reaction Kinetics; Thermal Decomposition; Dissociation

20020068896 Department of the Navy, Washington, DC USA

Non-Chromate Metal Surface Etching Solutions

Tucker, Wayne C., Inventor; Medeiros, Maria G., Inventor; Brown, Richard, Inventor; Jul. 19, 2002; 14p; In English
Patent Info.: Filed 7 May 2002; US-Patent-Appl-SN-10143173

Report No.(s): AD-D020032; No Copyright; Avail: Defense Technical Information Center (DTIC)

Non-chromate solutions for treating and/or etching metals, particularly, aluminum, aluminum alloys, steel and titanium, and method of applying same wherein the solutions include either a titanate or titanium dioxide as a "drop-in replacement" for a chromium-containing compound in a metal surface etching solution that otherwise would contain chromium.

DTIC

Patent Applications; Aqueous Solutions; Aluminum Alloys; Metal Surfaces; Chromates

20020068948 Department of Energy, Washington, DC USA

Chemical Activation of Molecules by Metals: Experimental Studies of Electron Distributions and Bonding. Final Report Summary Final Report

2002; 32p

Report No.(s): DE2002-792911; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research program is directed at obtaining detailed experimental information on the electronic interactions between metals and organic molecules. These interactions provide low energy pathways for many important chemical and catalytic processes. A major feature of the program is the continued development and application of our special high-resolution valence photoelectron spectroscopy (UPS), and high-precision X-ray core photoelectron spectroscopy (XPS) instrumentation for study of organometallic molecules in the gas phase. The study involves a systematic approach towards understanding the interactions and activation of bound carbonyls, C-H bonds, methylenes, vinylidenes, acetylides, alkenes, alkynes, carbenes, carbynes, alkylidenes, alkylidynes, and others with various monometal, dimetal, and cluster metal species. Supporting ligands include -aryls, alkoxides, oxides, and phosphines. We are expanding our studies of both early and late transition metal species and electron-rich and electron-poor environments in order to more completely understand the electronic factors that serve to stabilize particular organic fragments and intermediates on metals. Additional new directions for this program are being taken in ultra-high vacuum surface UPS, XPS, scanning tunneling microscopy (STM) and atomic force microscopy (AFM) experiments on both physisorbed and chemisorbed organometallic thin films. The combination of these methods provides additional electronic

structure information on surface-molecule and molecule-molecule interactions. A very important general result emerging from this program is the identification of a close relationship between the ionization energies of the species and the thermodynamics of the chemical and catalytic reactions of these systems.

NTIS

Alkynes; Ligands; Fullerenes; Chemical Reactions; Organometallic Compounds

20020068992 Argonne National Lab., IL USA

Towards Ultrasensitive Isotope Trace Analysis of (41)Ca

2002; 16p; In English

Report No.(s): DE2002-43026; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An Atom Trap Trace Analysis (ATTA) system based on the technique of laser manipulation of neutral atoms is being developed to count individual (sup 41)Ca atoms present in natural samples with an isotopic abundance of 10(sup -15). Trapping of all stable calcium isotopes has been demonstrated and single-atom counting has been realized. For the most abundant isotope, (sup 40)Ca (97% isotopic abundance), a magneto-optical trap (MOT) loading rate of 2×10^{10} atoms/s has been reached at the overall capture efficiency of 1×10^{-4} . System improvements could increase the efficiency by at least an order of magnitude.

NTIS

Calcium Isotopes; Loading Rate; Magneto-Optics

20020069118 NASA Ames Research Center, Moffett Field, CA USA

Heats of Formation for CF(sub n) (n = 1 - 4), CF(sup +, sub n) (n = 1 - 4), and CF(sup -, sub n) (n = 1 - 3)

Ricca, Alessandra, NASA Ames Research Center, USA; [1998]; 14p; In English

Contract(s)/Grant(s): NAS2-14031; Copyright; Avail: Issuing Activity

Accurate heats of formation are computed for CF(sub n) (n = 1 - 4), CF(sup +, sub n) (n = 1 - 4), and CF(sup -, sub n) (n = 1 - 3). The geometries and vibrational frequencies are determined at the B3LYP level of theory. The energetics are determined at the CCSD(T) level of theory. Basis set limit values are obtained by extrapolation. In those cases where the CCSD(T) calculations become prohibitively large, the basis set extrapolation is performed at the MP2 level. The temperature dependence of the heat of formation, heat capacity, and entropy are computed for the temperature range 300 to 4000 K and fit to a polynomial.

Author

Heat of Formation; Polynomials; Specific Heat

20020070200 Honeywell Federal Mfg. and Technologies, Kansas City, MO USA

MESERAN Method: Rapid Quantification of Non-Volatile Organic Residue (NVOR)

Benkovich, M. G.; Anderson, J. L.; Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795278; KCP-613-6516; No Copyright; Avail: National Technical Information Service (NTIS)

The precision analytical technique known as MESERAN Analysis permits quantitative measurement of the level of preexisting nonvolatile organic residue (NVOR) on a substrate from is less than 1 nanogram (ng)/cm(sub 2) to is greater than 100 micrograms/cm(sub 2) in 2 minutes. MESERAN Analysis is also applicable to determining NVOR in solvents and solvent extracts. The MESERAN method is able to quantify organic contamination levels down to and below 1 ng by depositing as little as 10 microliters of solvent containing a known amount of contamination on a clean substrate, allowing it to evaporate, and measuring the evaporated residue. The method will be described in detail and NVOR measurements determined from MESERAN data will be presented.

NTIS

Surfaces; Deposition; Residues

20020070216 Rockwell International Science Center, Thousand Oaks, CA USA

Investigation of the Mechanism of IGA/SCC of Alloy 600 in Corrosion Accelerating Heated Crevice Environments, 18 Aug. 1999 - 31 Aug. 2000

Lumsden, J.; Nov. 2000; 22p; In English

Report No.(s): DE2002-769257; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The crevice formed by the tube/tube support plate (T/TSP) intersection in a pressurized water reactor (PWR) steam generator is a concentration site for nonvolatile impurities (referred to as hideout) in the steam generator water. The restricted mass transport in the small crevice volume prevents the species, which concentrate by a thermal/hydraulic mechanism during the generation of

steam, from quickly dispersing into the bulk water. The presence of a porous scale corrosion product on the surface of the tube and deposits of corrosion products in the crevice further restrict mass transport. The objective of this program is to develop an understanding of the corrosion accelerating mechanisms, particularly IGA/SCC, in steam generator crevices. The important variables will be identified, including the relationship between bulk water chemistry and corrosion accelerating chemistries in a crevice. An important result will be the identification of water chemistry control measures needed to mitigate secondary side IGA/SCC in steam generator tubes. The approach uses an instrumented heated crevice, which is a replica of a PWR steam generator T/TSP crevice. While the system is operating at simulated steam generator thermal conditions, measurements can be made of the chemical, electrochemical, and thermal conditions in the crevice. Damage to the tube due to IGA/SCC and other corrosion processes will be monitored using electrochemical noise.

NTIS

Stress Corrosion Cracking; Intergranular Corrosion; Pressurized Water Reactors; Corrosion; Boilers

20020070376 NASA Ames Research Center, Moffett Field, CA USA

Large-Scale Processing of Carbon Nanotubes

Finn, John, NASA Ames Research Center, USA; Sridhar, K. R., NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; [1998]; 1p; In English; Nano-98, 1-6 Nov. 1998, Houston, TX, USA

Contract(s)/Grant(s): RTOP 632-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

Scale-up difficulties and high energy costs are two of the more important factors that limit the availability of various types of nanotube carbon. While several approaches are known for producing nanotube carbon, the high-powered reactors typically produce nanotubes at rates measured in only grams per hour and operate at temperatures in excess of 1000 C. These scale-up and energy challenges must be overcome before nanotube carbon can become practical for high-consumption structural and mechanical applications. This presentation examines the issues associated with using various nanotube production methods at larger scales, and discusses research being performed at NASA Ames Research Center on carbon nanotube reactor technology.

Author

Large Space Structures; Carbon Nanotubes; Nanostructure Growth; Technology Assessment

20020070585 Argonne National Lab., IL USA

Development of CaO Coatings by Thermal and Chemical Vapor Deposition

Natesan, K.; Uz, M.; Smith, D. L.; Apr. 2002; 18p; In English

Report No.(s): DE2002-42877; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We conducted several experiments to test electrically insulating CaO coatings on a V-4Cr-4Ti alloy for application in the Li environment of liquid metal blankets in fusion reactors. Two processes that involve double Ca deposition/oxidation steps were developed to successfully coat V-4Cr-4Ti alloy samples with stable CaO. During the study, we examined several geometrical arrangements, using tabs and/or rod specimens. After Ca deposition from the vapor phase, the specimens were oxidized in an Ar-10 vppm O₂ environment at approximately 600 degrees C to convert the deposited metal into oxide, whereupon they exhibited insulating characteristics. Several coated specimens were then exposed to Li-2.8 at.%Ca at 500-700 degrees C to determine chemical compatibility and mechanical integrity. Depth profile analysis of the coatings was conducted to evaluate the compositional changes in the coatings and to assess the transport, if any, of substrate and coating constituents. Microstructural characteristics of the coatings were evaluated by scanning electron microscopy. The preliminary results indicate that CaO is a viable coating for V-Li advanced blankets.

NTIS

Coatings; Vapor Deposition; Vapor Phases; Chemical Compatibility; Oxidation

26

METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20020067717 Texas A&M Univ., Dept. of Aerospace Engineering, College Station, TX USA

Dynamic Loading of Polycrystalline Shape Memory Alloy Rods

Lagoudas, Dimitris C.; Ravi-Chandar, K.; Sarh, Khalid; Popov, Peter; May 27, 2002; 42p; In English; Prepared in cooperation with University of Texas, Austin, and University of Houston. Preprint submitted to Mechanics of Materials

Contract(s)/Grant(s): M00014-99-1-1069; F49620-01-1-0196

Report No.(s): AD-A403826; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Shape Memory Alloys (SMAs) have recently been considered for dynamic loading applications for energy absorbing and vibration damping devices. An SMA body subjected to external dynamic loading will experience large inelastic deformations that will propagate through the body as phase transformation and/or detwinning shock waves. The wave propagation problem in a cylindrical polycrystalline SMA rod induced by an impact loading is considered in this paper. Numerical solutions for various boundary conditions are presented for stress induced martensite and detwinning of martensite. The numerical simulations utilize an adaptive Finite Element Method (FEM) based on the Zienkiewicz-Zhu (ZZ) error estimator. Selected results are compared to known analytical solutions to verify the adaptive FEM approach. The energy dissipation in an SMA rod is evaluated for a square pulse stress input applied at various temperatures involving both stress induced martensite and detwinning of martensite. The dynamic response of a NiTi SMA rod is also studied experimentally in a split Hopkinson bar apparatus under detwinning conditions. Strain history records obtained by strain gauges placed at different locations along the SMA rod are compared with numerical simulations for a square pulse stress input. The quasi-static and dynamic stress-strain hysteretic response of the SMA, both due to detwinning, are found to be nearly identical. The quasi-static tests are used to calibrate the rate independent constitutive model used for the numerical simulations, which are found to match the experimental observations reasonably well.

DTIC

Shape Memory Alloys; Numerical Analysis; Nickel Alloys; Mathematical Models; Titanium Alloys; Boundary Conditions; Finite Element Method

20020067758 Colorado Univ., Boulder, CO USA

Parallel Fabrication and Optoelectronic Characterization of Nanostructured Surfaces *Final Report, 1 Feb. 1999-30 Jun. 2002*

Douglas, Kenneth; Winningham, Thomas A.; Jun. 30, 2002; 6p; In English

Contract(s)/Grant(s): F49620-99-1-0105; Proj-2305

Report No.(s): AD-A403786; AFRL-SR-AR-TR-02-0212; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Among the more notable accomplishments during the course of this contract we identify the following results: (1) We have used diblock copolymers to transfer nanoscale periodic patterns to substrates. The nanopatterns have been transferred both in the form of etched holes and in arrays of metal dots. This has been performed without the need for silicon nitride layers or multi-layered resists. (2) We have conducted experiments using a closed-loop MM to measure the coefficient of thermal expansion (CTE) of a reference material. We have found that the piezo scanner non-linearity (0.2%) is unacceptably large for metrologic MM Moire interferometry. We have ordered a new closed-loop MM that incorporates a flexure-based scanner with a nonlinearity of 0.05%. The new instrumentation will allow us to overcome the piezo non-linearity difficulties, and (3) We have demonstrated a method for utilizing nanomasks for pattern transfer to an arbitrary substrate via an intermediate transfer layer (ITL). This approach is distinct from the technique of applying the nanomasks directly to the surface to be patterned. The ITL is a layer of a resist-like material into which the bionanomask pattern is transferred before it is then transferred to the substrate.

DTIC

Metal Films; Surfaces; Feedback Control; Copolymers

20020067789 NASA Marshall Space Flight Center, Huntsville, AL USA

Pore Formation and Mobility (PFMI): An International Space Station Glovebox Investigation

Grugel, R. N., NASA Marshall Space Flight Center, USA; Anilkumar, A., NASA Marshall Space Flight Center, USA; Jeter, L., NASA Marshall Space Flight Center, USA; Luz, P., NASA Marshall Space Flight Center, USA; Volz, M. P., NASA Marshall Space Flight Center, USA; Spivey, R., NASA Marshall Space Flight Center, USA; Smith, G., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Porosity in the form of "bubbles and pipes" can occur during controlled directional solidification processing of metal alloys. It is detrimental to material properties and precludes obtaining meaningful scientific results. On Earth, density differences allow an initiated bubble can rise through the liquid and "pop" at the surface resulting in a sound casting. This is not likely to occur in a microgravity environment and, unfortunately, a number of experiments conducted in microgravity have suffered from porosity effects. The current investigation is a systematic effort towards understanding porosity formation and mobility during controlled directional solidification in a microgravity environment. This will be investigated by utilizing a transparent material, succinonitrile (SCN), in conjunction with a translating temperature gradient stage so that direct observation and recording of pore generation and mobility can be made. The talk will cover the porosity problem, the details of the proposed experiments and the experimental hardware, and the expectations from the microgravity experiments.

Author

Directional Solidification (Crystals); Gravitational Effects; Porosity; Transparency

20020068064 Cincinnati Univ., Dept. of Materials Science and Engineering, OH USA

Microstructure Effects on Creep Behavior of Next Generation of Refractory Alloys for Very High Temperature Applications Final Report, 1 Jan.-31 Dec. 2000

Vasudevan, Vijay K.; Leonard, Keith J.; Jun. 13, 2002; 29p; In English

Contract(s)/Grant(s): F49620-00-1-0080

Report No.(s): AD-A403745; AFRL-SR-AR-TR-02-0222; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objective of the present project was to gain a basic understanding of the effects of microstructure on the creep behavior of a new class of Mo-Si-B alloys that are being considered for very high temperature structural applications. A second objective was to obtain insight into the oxidation behavior of these materials. During this one-year project, thermal effects on microstructure evolution in a Mo-7.44Si-8.51B (at.%) alloy were studied. The results indicate that it is possible to exert some control over microstructure and properties by very high temperature heat treatments. Significant changes in volume fraction of alpha-Mo, Mo₃Si and T₂ phases occur at temperatures greater than - 1700 deg C. The cyclic oxidation behavior in air at temperatures between 800 - 1100 deg C were also studied in a three-phase Mo-12Si-12B (at.%) and near-single T₂ phase Mo-12.5Si-25B alloy. The results indicate that catastrophic oxidation occurs in both alloys at/below 800 - 900 deg C; performance and oxidation protection is better at greater than - 1000 deg C. A porous, non-protective borosilicate/B-SiO₂ layer forms at low temperatures, which permits easy oxygen diffusion and increased weight loss through volatilization of Mo as Mo₃ gas. A stable, dense silica scale forms at/above 1000 deg C, which provides protection from oxidation and reduced weight loss.

DTIC

Creep Properties; High Temperature; Microstructure; Refractory Metal Alloys; Borosilicate Glass

20020068073 Texas A&M Univ., Texas Engineering Experiment Station, College Station, TX USA

Dynamic Behavior and Shock Absorption Properties of Porous Shape Memory Alloys Final Report, 9 Jun. 1999-30 Jun 2001

Lagoudas, Dimitris C.; Jul. 08, 2002; 12p; In English

Contract(s)/Grant(s): N00014-99-1-1069

Report No.(s): AD-A403775; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two methods for producing porous NiTi shape memory alloy (SMA) were used in this work: conventional sintering and sintering at elevated pressure using a Hot Isostatic Press. Depending on various parameters such as sintering times and temperatures, as well as initial powder size and compaction, porous specimens have been produced with varying average pore sizes. The phase transformation temperatures of the porous NiTi specimens were determined using a Differential Scanning Calorimeter, while their microstructure and phase compositions were analyzed using X-Ray Diffraction and a Scanning Electron Microscope aided with Electron-Probe Micro Analysis. Quasi-static and dynamic tests under compression were carried out on various porous NiTi samples to evaluate the pseudo-elasticity and the martensitic detwinning behavior. The effective response of the porous SMAs was modeled using micromechanical averaging techniques. The current work establishes a macroscopic constitutive model for the porous SMA material using the properties of the dense SMA and information about pore shape, volume fraction as well as given pore orientation. A constitutive model for the SMA matrix, which is capable of accounting for the development of plastic strains, was developed as part of the modeling effort. The results from the numerical simulations were compared with the experimental data.

DTIC

Binary Alloys; Porous Materials; Shape Memory Alloys; Absorption; Powder Metallurgy; Dynamic Characteristics; Mathematical Models; Micromechanics

20020068382 Texas A&M Univ., Dept. of Aerospace Engineering, College Station, TX USA

Porous Shape Memory Alloys. Part 2. Modeling of the Thermomechanical Response

Entchev, Pavlin B.; Lagoudas, Dimitris C.; Qidwai, Muhammad A.; DeGiorgi, Virginia G.; Jan. 2000; 12p; In English; Prepared in cooperation with Geo-Centers, Inc. Fort Washington, MD; Naval Research Lab. Washington, DC. See Also ADA403940

Report No.(s): AD-A403941; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Shape memory alloys (SMAs) have emerged as a class of materials with unique thermal and mechanical properties that have found numerous applications in various engineering areas. There have been a variety of applications that perform in a quasi-static manner. Recent work has proposed the use of porous SMAs as an energy absorbing material under dynamic loading conditions. Porous SMAs hold the promise of making high-efficiency damping devices that are superior to those made of conventional materials. The focus of this work is on establishing the quasi-static properties of porous SMA material. to accomplish this, a micromechanics-based analysis of the overall behavior of porous SMA is carried out. The porous SMA is modeled as a composite with SMA matrix, which is modeled using an incremental formulation, and pores as inhomogeneities of zero stiffness. The

macroscopic constitutive behavior of the effective medium is established using the incremental Mori-Tanaka averaging method for a random distribution of pores, and a FEM analysis of a unit cell for a periodic arrangement of pores. In addition, a mesoscale level analysis allowing for the examination of pore size and shape variation effects is performed.

DTIC

Shape Memory Alloys; Porous Materials; Mechanical Properties; Thermodynamic Properties; Absorbers (Materials)

20020068796 Alabama Univ., Dept. of Chemistry, Huntsville, AL USA

Viscosity Relaxation in Molten HgZnTe

Baird, James K., Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. IV-1 - IV-16; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Because of its narrow electronic band-gap, HgZnTe solid solutions have been proposed as effective detectors for infrared radiation. to produce the best single crystals of these materials for this application, knowledge of the phase diagram that governs the freezing of the liquid is essential. Besides the phase diagram, however, some information concerning the thermophysical properties of the melt, such as viscosity, density, specific heat, and enthalpy of mixing, can also be useful. of these thermophysical properties, the viscosity is perhaps of the most interest scientifically. Measurements using the oscillating cup method have shown that the isothermal melt requires tens of hours of equilibration time before a steady value of the viscosity can be achieved. Over this equilibration time, which depends upon temperature, the viscosity can increase by as much as a factor of two before reaching a steady state. We suggest that this relaxation phenomenon may be due to a slight polymerization of Te atoms in the melt. To account for the time dependence of the viscosity in the HgZnTe melt, we propose that the liquid acts as a solvent that favors the formation of Te atom chains. We suggest that as the melt is cooled from a high temperature to the temperature for measurement of the viscosity, a free radical polymerization of Te atoms begins. to estimate this average molecular weight, we use a simple free radical polymerization mechanism, including a depolymerization step, to calculate the time dependence to the concentration of each Te polymer molecular weight fraction. From these molecular weight fractions, we compute the weight average molecular weight of the distribution. Using the semi-empirical relation between average molecular weight and viscosity, we obtain a formula for the time dependence of the viscosity of the melt. Upon examining this formula, we find that the viscosity achieves a steady value when a balance is achieved between the rate of formation of the chains and the rate of their depolymerization into species which do not effect the viscosity.

Derived from text

Phase Diagrams; Solid Solutions; Thermophysical Properties; Energy Gaps (Solid State); Mercury Tellurides; Zinc Tellurides; Melts (Crystal Growth); Viscosity

20020068815 State Univ. of New York, Mechanical Engineering Dept., Farmingdale, NY USA

Micro-Mechanical Modeling of Ductile Fracture in Welded Aluminum-Lithium Alloys

Ibrahim, Ahmed, State Univ. of New York, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXIV-1 - XXIV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

This computation model for microscopic crack growth in welded aluminum-lithium alloys consists of a cavity with initial volume specified by the fraction $f(\text{sub } 0)$, i.e. the void volume relative to the cell volume. Thus, cell size D and initial porosity $f(\text{sub } 0)$ defines the key parameters in this model. The choice of cell size requires: 1) D must be representative of the large inclusion spacing. 2) Predicted R-curves scale almost proportionally with D for fixed $f(\text{sub } 0)$. 3) mapping of one finite element per cell must provide adequate resolution of the stress-strain fields in the active layer and the adjacent material. For the ferritic steels studied thus far with this model, calibrated cell sizes range from 50-200 microns with $f(\text{sub } 0)$ in the 0.0001 to 0.004 micron range. This range of values for D and $f(\text{sub } 0)$ satisfies issues 1) and 3). This computational model employs the Gurson and Tvergaard constitutive model for porous plastic materials to describe the progressive damage of cells due to the growth of pre-existing voids. The model derives from a rigid-plastic limit analysis of a solid having a volume fraction (f) of voids approximated by a homogenous spherical body containing a spherical void.

Author

Aluminum-Lithium Alloys; Mathematical Models; Crack Propagation; Fracture Mechanics; Voids; Microcracks

20020068894 Northwestern Univ., Materials Research Center, Evanston, IL USA

Electronic-Level Design of Stress-Corrosion Resistant Alloys: Quantum Steels *Final Report, Dec. 1993-Dec 2001*

Olson, Gregory B.; Ellis, D. E.; Freeman, A. J.; Jul. 24, 2002; 10p; In English

Contract(s)/Grant(s): N00014-94-1-0188

Report No.(s): AD-A403902; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As part of an integrated computational materials design effort, quantum mechanical calculations have predicted the roles of impurity and alloying elements in grain boundary cohesion to support design of hydrogen-resistant ultrahigh-strength steels. Predicted thermodynamic quantities have been integrated in systems design of new steels employing W, Re and B for enhanced cohesion. A prototype steel has demonstrated an ultimate tensile strength of 330 ksi with good toughness and ductility, while maintaining desired grain boundary composition.

DTIC

Alloying; Corrosion Resistance; High Strength Steels; Grain Boundaries

20020068951 Rockwell International Corp., Thousand Oaks, CA USA

Investigation of the Mechanism of IGA/SCC of Alloy 600 in Corrosion Accelerating Heated Crevice Environments. Topical Report - Results for Mod of Heated Crevice (08/18/1999 - 08/31/2000)

Lumsden, J.; Nov. 2000; 24p; In English

Report No.(s): DE2002-769287; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The crevice formed by the tube/tube support plate (T/TSP) intersection in a pressurized water reactor (PWR) steam generator is a concentration site for nonvolatile impurities (referred to as hideout) in the steam generator water. The restricted mass transport in the small crevice volume prevents the species, which concentrate by a thermal/hydraulic mechanism during the generation of steam, from quickly dispersing into the bulk water. The presence of a porous scale corrosion product on the surface of the tube and deposits of corrosion products in the crevice further restrict mass transport. The objective of this program is to develop an understanding of the corrosion accelerating mechanisms, particularly IGA/SCC, in steam generator crevices. The important variables will be identified, including the relationship between bulk water chemistry and corrosion accelerating chemistries in a crevice. An important result will be the identification of water chemistry control measures needed to mitigate secondary side IGA/SCC in steam generator tubes. The approach uses an instrumented heated crevice, which is a replica of a PWR steam generator T/TSP crevice. While the system is operating at simulated steam generator thermal conditions, measurements can be made of the chemical, electrochemical, and thermal conditions in the crevice. Damage to the tube due to IGA/SCC and other corrosion processes will be monitored using electrochemical noise.

NTIS

Intergranular Corrosion; Stress Corrosion Cracking; Pressurized Water Reactors; Scale (Corrosion); Boilers

20020068963 Argonne National Lab., IL USA

Dislocation Processes and Deformation Twinning in Nanocrystalline Al

Yamakov, V.; Wolf, D.; Phillpot, S. R.; Gleiter, H.; 2002; 8p; In English

Report No.(s): DE2002-41676; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Using a recently developed, massively parallel molecular-dynamics (MD) code for the simulation of polycrystal plasticity, we analyze for the case of nanocrystalline Al the complex interplay among various dislocation and grain-boundary processes during low-temperature deformation. A unique aspect of this work, arising from our ability to deform to rather large plastic strains and to consider a rather large grain size, is the observation of deformation under very high grain-boundary and dislocation densities, i.e., in a deformation regime where they compete on an equal footing. We are thus able to identify the intra- and intergranular dislocation and grain-boundary processes responsible for the extensive deformation twinning observed in our simulations. This illustrates the ability of this type of simulations to capture novel atomic-level insights into the underlying deformation mechanisms not presently possible experimentally.

NTIS

Mechanical Twinning; Deformation; Aluminum Alloys

20020069085 Helsinki Univ. of Technology, Lab. of Materials Processing and Powder Metallurgy, Espoo, Finland

Atmospheric Direct Leaching of Sphalerite, Part 2, Reaction Kinetics

Kaskiala, T.; 2001; 34p; In English

Report No.(s): PB2002-105015; TKK-MK-125; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Zinc, which is formerly produced by pyrometallurgical processes, is now mainly produced using a roast-leach electrowinning process. The production is thus more efficient with respect to manpower, energy and pollution abatement. Furthermore, low grade complex ores can be leached. // The objective in the direct leaching is to obtain the zinc into solution directly from the sulphidic form from a zinc sulphide concentrate. The direct leaching of zinc concentrate under atmospheric pressure is the new technology arising in the zinc production. As a relatively new process (in use), it still involves areas, which are poorly known and reliable models proposed for the leaching mechanism and kinetics are necessary. One among the most popular is the shrinking-core model,

which characterizes the formation of a product layer on the surface of the sphalerite particle. For a better understanding of the leaching process, it is important to know the chemical and physical events and their effects.

NTIS

Leaching; Kinetics; Atmospheric Pressure

20020069093 Steel Founders' Society of America, Des Plaines, IL USA

Feeding and Riser Guidelines for Steel Castings

2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793381; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents work conducted on the following main projects tasks undertaken in the Yield Improvement in Steel Casting research program: Improvement of Conventional Feeding and Riser Methods, Use of Unconventional Yield Improvement Techniques, and Case Studies in Yield Improvement. Casting trials were conducted and then simulated using the precise casting conditions as recorded by the participating SFSA foundries. These results present a statistically meaningful set of experimental data on soundness versus feeding length. Comparisons between these casting trials and casting trials performed more than forty years ago by Pellini and the SFSA are quite good and appear reasonable. Comparisons between the current SFSA feeding rules and feeding rules based on the minimum Niyama criterion reveal that the Niyama-based rules are generally less conservative. The Niyama-based rules also agree better with both the trials presented here, and the casting trials performed by Pellini and the SFSA years ago. Furthermore, the use of the Niyama criterion to predict centerline shrinkage for horizontally fed plate sections has a theoretical basis according to the casting literature reviewed here. These results strongly support the use of improved feeding rules for horizontal plate sections based on the Niyama criterion, which can be tailored to the casting conditions for a given alloy and to a desired level of soundness. The reliability and repeatability of ASTM shrinkage x-ray ratings was investigated in a statistical study performed on 128 x-rays, each of which were rated seven different times. A manual 'Feeding and Riser Guidelines for Steel Castings' is given in this final report. Results of casting trials performed to test unconventional techniques for improving casting yield are presented. These use a stacked arrangement of castings and riser pressurization to increase the casting yield. Riser pressurization was demonstrated to feed a casting up to four times the distance of a non-pressurized riser, and can increase casting yield by decreasing the required number of risers. All case studies for this project were completed and compiled into an SFSA Technical Report that is submitted part of this Final Report.

NTIS

Castings; Foundries; Risers; Feeding (Supplying)

20020070208 Oak Ridge National Lab., TN USA

AISI/DOE Technology Roadmap Program. TRP 9732: Steel Processing Properties and Their Effect on Impact Deformation of Lightweight Structures

Simunovic, S.; Aramayo, G.; Jan. 2001; 68p; In English

Report No.(s): DE2002-794991; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of the research was to perform a comprehensive computational analysis of the effects of material and process modeling approaches on performance of Ultra Light Steel Auto Body (ULSAB) vehicle models. The research addressed numerous material related effects, impact conditions as well as analyzed the performance of the ULSAB vehicles in crashes against designs representing the current US vehicle fleet. Crash modeling simulations show a clear effect of strain-rate sensitivity on high strength steel (HSS) intensive vehicle. The influence of a strain-rate model can be an incremental sensitivity due to the increased flow stress when similar structure collapse modes are predicted. However, significant differences in crash energy management capacity can be predicted if the change in loading on members alters the predicted collapse mode of the structure.

NTIS

Steels; Process Control (Industry)

20020070209 American Iron and Steel Inst., Pittsburgh, PA USA

AISI/DOE Advanced Control Program, Volume 4, On-line, Non-Destructive Mechanical Property Measurement Using Laser-Ultrasound

Moreau, A.; Lord, M.; Levesque, D.; Dubois, M.; Bussiere, J.; Mar. 2001; 114p; In English

Report No.(s): DE2002-794988; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The goal of this project was to demonstrate the feasibility to measure the mechanical properties, such as yield strength, tensile strength, elongation, strain hardening exponent and plastic strain ratio parameters, of low carbon steel sheets on the production line using laser ultrasound. The ultrasound generated by the developed apparatus travels mostly back and forth in the thickness of the steel sheet. by measuring the time delay between two echoes, and the relative amplitude of these two echoes, one can

measure ultrasound velocity and attenuation. These are governed by the microstructure: grain size, crystallographic texture, dislocations, etc. Thus, by recording the time behavior of the ultrasonic signal, one can extract microstructural information. These microstructural information together with the modified Hall-Petch equation allow measurement of the mechanical properties

NTIS

Mechanical Properties; Low Carbon Steels

20020070221 Oak Ridge National Lab., TN USA

ASSET: An Information System for Alloy Corrosion in High Temperature Gases

John, R. C.; Thompson, W. T.; Young, A. L.; Wright, I. G.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-782932; No Copyright; Avail: National Technical Information Service (NTIS)

A large database for corrosion data and a corrosion prediction information system for metals and alloys corroding in high-temperature gases have been created. Corrosion data for about 75 commercial alloys, 4600 corrosion data measurements, and six million exposure hours have been compiled into an information system, ASSET. ASSET allows prediction of sound metal thickness losses for metals and alloys corroding by several common corrosion mechanisms at high-temperatures as functions of gas composition, temperature, time, and alloy. This paper presents examples of predicted metal losses of alloys corroding in standard conditions for several corrosion mechanisms expected in high-temperature gases. ASSET also provides a comprehensive capability to analyze the thermochemical interactions between alloys, corrosion products and exposure conditions. Some of the uses of the data compilation and the corrosion prediction feature are illustrated for oxidizing, sulfidizing, sulfidizing/oxidizing, and carburizing conditions.

NTIS

Corrosion; Information Systems; Alloys; Prediction Analysis Techniques; Thermochemistry; High Temperature Gases

20020070288 NASA Ames Research Center, Moffett Field, CA USA

Effect of Measured Welding Residual Stresses on Crack Growth

Hampton, Roy W., NASA Ames Research Center, USA; Nelson, Drew, Stanford Univ., USA; Oct. 01, 1998; 1p; In English; ASTM 31st National Symposium Fatigue and Fractures Mechanics, 22-24 Jun. 1999, Cleveland, OH, USA; Sponsored by American Society for Testing and Materials, USA

Contract(s)/Grant(s): RTOP 297-10-02; No Copyright; Avail: Issuing Activity; Abstract Only

Welding residual stresses in thin plate A516-70 steel and 2219-T87 aluminum butt weldments were measured by the strain-gage hole drilling and X-ray diffraction methods. The residual stress data were used to construct 3D strain fields which were modeled as thermally induced strains. These 3D strain fields were then analyzed with the WARP31) FEM fracture analysis code in order to predict their effect on fatigue and on fracture. For analyses of fatigue crack advance and subsequent verification testing, fatigue crack growth increments were simulated by successive saw-cuts and incremental loading to generate, as a function of crack length, effects on crack growth of the interaction between residual stresses and load induced stresses. The specimen experimental response was characterized and compared to the WARM linear elastic and elastic-plastic fracture mechanics analysis predictions. to perform the fracture analysis, the plate material's crack tearing resistance was determined by tests of thin plate M(T) specimens. Fracture analyses of these specimen were performed using WARP31D to determine the critical Crack Tip Opening Angle [CTOA] of each material. These critical CTOA values were used to predict crack tearing and fracture in the weldments. to verify the fracture predictions, weldment M(T) specimen were tested in monotonic loading to fracture while characterizing the fracture process.

Author

Welding; Residual Stress; Crack Propagation; Fracture Mechanics; Plastic Properties

20020070547 North Dakota State Univ., Fargo, ND USA

Binder Modification and Development for Briquetting Steel Mill Residues *Final Report, 2 Jun. 1997 - 30 Jun. 1998*

Olson, E. S.; Jul. 1998; 96p; In English

Report No.(s): DE2002-793655; REPT-98-EERC-07-02; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Alternatives to the molasses-ordinary portland cement (OPC) binder as a binder for steel mill residues were extensively investigated. A large number of binder modifications were tested using a hand pelleting apparatus to identify effective compositions. The more effective compositions were evaluated in a series of three briquetting matrices using the Komarek press. Evaluations consisted of drop tests, compression tests of given and cured pellets, and tumble tests of cured pellets. Pyrolysis odor tests were performed to determine the effects of certain compositions on the disagreeable wet campfire odor produced during

heating of the molasses--OPC briquettes. Several scanning electron microscope (SEM) morphology studies were conducted to examine the nature of structures formed during pelleting or briquetting.

NTIS

Steels; Cements; Binders (Materials); Morphology

20020070588 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Element-Specific Soft X-Ray Magneto-Optic Rotation Studies of Magnetic Films and Multilayers

Kortright, J. B.; Rice, M.; May 1996; 12p; In English

Report No.(s): DE2002-270797; LBNL-389000; UC-410; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tunable multilayer linear polarizers extend magneto-optic rotation techniques that directly sense polarization changes into the 50--1,000 eV range. The resonant response at atomic core levels yields element-specific magnetic signals that can be much larger than the analogous signal in the visible. A tunable multilayer polarimeter is described, and examples of its use in early Kerr rotation hysteresis studies of Fe films and Fe/Cr multilayers are given.

NTIS

Magnetic Materials; Magneto-Optics; Magnetic Films; Rotation

20020070593 California Univ., Lawrence Berkeley National Lab., Materials Science Div., Berkeley, CA USA

Transmission Electron Microscopy Studies of Electrical Active GaAs/GaN Interface Obtained by Wafer Bonding

Jasinski, J.; Liliental-Weber, Z.; Estrada, S.; Hu, E.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795386; No Copyright; Avail: National Technical Information Service (NTIS)

Transmission electron microscopy (TEM) and energy dispersive X-ray spectroscopy (EDX) studies of GaAs/GaN interfaces, obtained by direct wafer bonding, are presented. TEM observations show that most of the interface area was well bonded. A thin oxide layer, confirmed by EDX, was present at the interface in the well-bonded regions. Plan-view TEM studies showed the presence of two dislocation networks in such regions. They formed to accommodate: (1) tilt between bonded crystals and (2) strain, which appeared during sample cooling due to mismatch in thermal expansion coefficients. Asymmetrical, often elongated, cavities, formed on the GaAs side, were present at the interface between the well-bonded regions. It was shown by EDX that the walls of these cavities are covered with native oxide.

NTIS

Transmission Electron Microscopy; Gallium Nitrides; Gallium Arsenides

20020070630 NASA Glenn Research Center, Cleveland, OH USA

Aerospace Structural Materials Handbook Supplement GRCop-84

Ellis, David L., Case Western Reserve Univ., USA; Oct. 24, 2001; 58p; In English

Contract(s)/Grant(s): NCC3-830; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

GRCop-84 is a high strength-high conductivity copper-based alloy developed at NASA Glenn Research Center for combustion chamber liners of regeneratively cooled rocket engines. It also has promise for other high heat flux applications operating at temperatures up to 700 C (1292 F) and potentially higher. The alloy must be made by powder metallurgy techniques such as gas atomization. Slower cooling rates such as those experienced during casting do not develop a proper microstructure. Once made into powder, the alloy exhibits excellent processability using conventional consolidation and forming techniques, e.g., extrusion and rolling. GRCop-84 is strengthened by a combination of dispersion and precipitation strengthening by fine (50-500 nanometer (2-20 microinch)) Cr₂Nb particles and Hall-Petch strengthening from a fine copper grain size. The presence of a high volume fraction of particles prevents grain boundary sliding at high temperatures and contributes to the alloy's overall good high temperature mechanical properties. Maximum thermal conductivity is obtained by using two alloying elements (Cr, Nb) with limited solubility in solid Cu that form a high temperature intermetallic compound with an even lower solid solubility. The resulting matrix of the alloy is nearly pure copper. The limited solubility also minimizes Cr₂Nb particle coarsening at elevated temperatures and enhances microstructural and mechanical property stability. Further enhancement of the microstructural stability is obtained by using a high volume fraction (approx. 14 vol.%) of Cr₂Nb particles that effectively pin grain growth.

Author

Copper Alloys; Mechanical Properties; Microstructure; Powder Metallurgy; Dispersion Strengthening

20020070676 Technical Research Centre of Finland, Espoo, Finland

Long-life Fatigue Design of GRP 500 Nodular Cast Iron Components

Marquis, G.; Solin, J.; 2000; 82p; In English

Report No.(s): PB2002-105684; VTT/RN-2043; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

A project on Spheroidal Cast Iron in Long-Life Design was realized in 1997 to 1999. The goal was to gain understanding of the fatigue mechanisms and obtain high cycle design information on GRP500 nodular cast iron under both constant amplitude and variable amplitude loading. All targets set at the beginning of the project have been achieved with the resources allocated. Several small but technically significant tasks have been added along the course of the project. In total 332 fatigue tests and extensive NDE studies on GRP 500 iron have been performed. The total number of fatigue cycles applied exceeded 3.10(sup9) cycles of which the majority were of variable amplitude such as may occur in rotating or reciprocating machines.

NTIS

Fatigue Life; Cast Alloys; Iron Alloys; Nondestructive Tests

20020070677 National Aerospace Lab., Amsterdam Netherlands

Further Evaluation of the Ascor Test for Stress Corrosion Testing of Aluminium Alloys

Schra, L.; Wanhill, R. J. H.; 2001; 32p; In English

Report No.(s): PB2002-105875; NLR/TP-97425-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1991 a simple automated stress corrosion testing method called the ASCOR (Automated Stress CORrosion Ring) test was developed to test aluminum alloys according to ASTM specification G49. The present investigation concentrated on evaluating two aspects of the test method: The SCC initiation criterion (2% load decrease); The possibility of defining a threshold stress for micro SCC growth in addition to that for macro SCC growth. It was found that substantial SCC growth had occurred at 2% load decrease. The authors therefore propose reducing the load decrease criterion to 1% as an improved compromise between determining the SCC initiation life in a well-defined way and limiting the contribution of SCC growth to this life. Fracture strength ratios (fracture strength of loaded exposed specimens divided by fracture strength of unloaded exposed specimens) less than 100% were found at exposure stresses below the threshold stress for macro SCC growth. Fractographic investigation showed SCC on the fracture surfaces of specimens tested at these exposure stresses. A threshold stress for micro SCC growth was determined and is defined as the exposure stress at and below which the fracture strength ratio is 100%.

NTIS

Corrosion Tests; Stress Corrosion; Aluminum Alloys

27

NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

20020067767 Technische Univ., Twente, Netherlands

Nanoscale Wear Resistant Ceramic Materials with Low Friction Final Report, 26 Apr. 2000-26 May 2001

Kerkwijk, Bas; Vancso, Gyula J.; Sep. 21, 2001; 123p; In English

Contract(s)/Grant(s): F81775-00-W-E009

Report No.(s): AD-A403730; EOARD-SPC-00-4009; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report results from a contract tasking University of Twente as follows: The contractor will investigate the improvement of tribological properties of zirconia/alumina composites by optimizing their microstructure and by addition of solids with friction-reducing properties.

DTIC

Wear Resistance; Tribology; Friction; Nanotechnology; Composite Materials

20020068067 Technion - Israel Inst. of Tech., Dept. of Materials Engineering, Haifa Israel

International Symposium on Self-Propagating High-Temperature Synthesis (SHS-2001) (6th) Held at Technion, Haifa, Israel on February 17-21, 2002. Book of Abstracts

Feb. 21, 2002; 117p; In English; Prepared in cooperation with ISMAN-Inst. of Structural Macrokinetics and Materials Science; Scientific Council on Combustion and Explosion, Russian Academy of Sciences

Contract(s)/Grant(s): N68171-01-M-6166

Report No.(s): AD-A403755; R/D-9185-MS-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Partial contents: Nanocrystalline Ceramics by Solid State Thermolysis of Metalorganic Polymers; Trends in Ceramic Materials Development into the Third Millennium; SHS of Dense in situ Composites via Pressure Assisted Thermal Explosion: experiment and modeling; Foreword; Contaminants, Additives and Dopants in Modern Materials Science; Inorganic Nanotubes and Inorganic Fullerene-like Materials from Layered Compounds: synthesis, properties and applications; Kinetics and Thermodynamics of SHS Reactions; Mechanical Alloying in the SHS Research; SHS in Electric and Magnetic Fields; SHS-Produced Composite Materials; Critical Phenomena at Autowave Propagation; Dynamics of Hot spots in Solid Flame Propagation; Electrothermal Explosion (ETE) method to Study the Kinetics of Fast High Temperature Reactions in Condensed Systems; Mutual Interdependence, between SHS Reaction and Gas Infiltration, during Thermal Explosion; On Spinning Modes of Gasless Combustion; The Present Status and trends of SHS FGM; Reactive Castings of Ceramic Composites; SHS of Complex Ceramic Materials and their Properties; SHS TiB₂ Based Multiphase Ceramics and Composites.

DTIC

Abstracts; High Temperature; Self Propagation; Conferences; Nanocrystals; Synthesis (Chemistry)

20020068096 Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

AASERT Student Research on In-Situ Toughened Alpha Prime-SiAlON Final Report, 15 Aug. 1998-31 Aug 2001

Chen, I-Wei; May 22, 2002; 7p; In English

Contract(s)/Grant(s): F49620-98-1-0470

Report No.(s): AD-A404120; AFRL-SR-AR-TR-02-0205; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The grant was initiated on May 15, 1998 and was completed in August 2001. We have explored the compositions at which in-situ toughened α -SiAlON can be obtained. This essentially encompasses the entire single α -phase region. It includes both rare-earth ion-added compositions and alkali/alkali-earth ion-added compositions. We have made a systematic effort to obtain kinetic data on phase transformation at different compositions, since this knowledge is critically important for the precise control of nucleation and growth, which dictate the microstructure. We have developed methods for controlling microstructure in α -SiAlON prepared from commercial α -Si₃N₄ powders. These materials have faster transformation rate and the microstructure control must rely on nucleation treatment of external seeding. We have developed the method to grow and harvest seed crystals, of a controlled composition, size and morphology, which can be used to nucleate α' -SiAlON grains in the ceramic to allow tailored grain growth. We have developed a theory for grain growth, based on the recent observations of the morphology of isolated grains from the oxynitride liquid. This model successfully predicted the novel shape transition observed experimentally. We have developed a wet chemical technique for etching the highly stable α' -SiAlON, which until now has proved difficult for ceranographic preparation. We have shown that the mechanical strength of α -SiAlON can exceed 1 GPa and the strength retention is good at least up to 1350 deg C. We have obtained R-curves for α' -SiAlON ceramics, and show that they can reach a toughness of 11-12 MPa m^{1/2} which compares favorably with the state-of-the-art Beta silicon nitride.

DTIC

Toughness; Ceramics; Oxynitrides; In Situ Measurement

20020068793 Alabama Agricultural and Mechanical Univ., Dept. of Electrical Engineering, Normal, AL USA

Microelectric Heterogeneous Hybrid Devices for Space Applications

Alim, Mohammad A., Alabama Agricultural and Mechanical Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. I-1 -I-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The existing projects designated as SACA (Sample Ampoule Cartridge/Container Assembly) and QMI (Quench Module Insert) at NASA's MSFC (Marshall Space Flight Center) involve development of high-temperature coating materials. A number of material systems need to be evaluated for this purpose. The requirement of these coating materials included high emissivity (approaching unity), sufficient physical strength, appropriate thermal conductivity to dissipate heat, and above all high temperature (T is equal to or greater than 2000 C) withstanding capability. Potential materials for applications considered were non-oxide based materials such as tungsten carbide, tantalum carbide, compounds of niobium, etc.

Derived from text

Coating; High Temperature; Refractory Materials; Refractory Coatings

20020068800 William Jewell Coll., Dept. of Physics, Liberty, MO USA

Molecular Probe Fluorescence Monitoring of Polymerization

Bunton, Patrick, William Jewell Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. VIII-1 - VIII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

This project investigated the feasibility of using fluorescence spectroscopy to determine viscosity of polymer/monomer in support of Transient Interfacial Phenomena in Miscible Polymer Systems (TIPMPS). This project will attempt to measure gradient induced flow at a miscible interface during and / or after in-flight polymerization of dodecyl acrylate (lauryl acrylate). Concentration and temperature gradients will be intentionally introduced during polymerization and the resultant fluid flow determined by Particle Imaging Velocimetry (PIV). This report describes an investigation of the feasibility of using fluorescence of a probe molecule to monitor viscosity and/or concentration during and after polymerization. The probe used was pyrene which has been shown to be sensitive to its local environment in methyl methacrylate.

Author

Fluorescence; Polymerization; Spectroscopy; Viscosity; Measuring Instruments

20020068811 South Dakota State Univ., Mechanical Engineering Dept., Brookings, SD USA

Analytical Modal Analysis for Thin-Film Flat Lenses

Hamidzadeh, Hamid R., South Dakota State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XX-1 - XX-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Due to strong potential applications and more demanding requirements imposed upon thin-film structures for space deployable, there has been increasing research and development activities during recent years in the field of vibration analysis of these types of structures. Moreover, interests in employing these structural components have received renewed emphasis in recent years within NASA and the Air Force. This is due to their inherent lightweight, low packaging and launch volume, and relative simplicity of deployment. Among the potential mission concepts for which these structural elements are included, one can mention solar sails, space solar power generation systems, solar thermal propulsion vehicles, large space telescopes, and inflatable communication antennas. This paper presents analytical procedures to determine vibration and physical characteristics of thin film lenses with circular and elliptical shapes membranes considered in design of a solar concentrator. In general, three methods are used to obtain approximate solutions of Helmholtz boundary value problems. One method requires that solution satisfy the differential equation exactly and the boundary condition approximately. Another method demands a solution that satisfies the boundary conditions exactly and the governing equations approximately. The third method sees a solution that satisfies both the governing equation and boundary conditions approximately. Extensive reviews of vibrations of membrane and plates are provided by Leissa and Mazumdar.

Author

Thin Films; Lenses; Membrane Structures; Large Space Structures; Space Erectable Structures; Research and Development; Structural Vibration; Boundary Value Problems

20020068902 Pennsylvania State Univ., University Park, PA USA

10TH US-Japan Seminar on Dielectric and Piezoelectric Ceramics Final Report, 9 Jan. 2000-30 Nov. 2002

McKinstry, Susan T.; Sep. 2001; 453p; In English; Original contains color images

Contract(s)/Grant(s): N00014-00-1-0911

Report No.(s): AD-A403905; ONR-332; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The award partially supported the technical workshop entitled '10th U.S.-Japan Workshop on Dielectric and Piezoelectric Materials'. This included the organization, mailing, abstract preparation, secretarial, travel, and related costs to hold a workshop. Held every two years, alternating from the U.S. and Japan, the workshop is a closed meeting, by 'invitation only', offering a highly interactive environment for technical exchange. The workshop took place September 27-29, 2001 in the Biltmore Hotel, Providence, Rhode Island. Topics covered included piezoelectric and dielectric materials and devices (including bulk, particulate, and thin film), and their processing technology. A proceedings of extended abstracts from the conference was distributed to participants.

DTIC

Dielectrics; Piezoelectric Ceramics; Conferences

20020068982 NASA Ames Research Center, Moffett Field, CA USA

Fluoropolymer Films Deposited by RF Plasma Sputtering of Polytetrafluoroethylene Using Inert Gases

Golub, Morton A., NASA Ames Research Center, USA; Wydeven, Theodore, Lockheed Martin Engineering and Sciences Co., USA; [1998]; 1p; In English; Fluorinated Surfaces, Coatings and Films Symposium, 23-28 Aug. 1998, Boston, MA, USA; Sponsored by American Chemical Society, USA

Contract(s)/Grant(s): RTOP 199-04-12-01; No Copyright; Avail: Issuing Activity; Abstract Only

The FT-IR (Fourier Transform Infrared), UV (Ultraviolet) and XPS (X Ray Photoelectron Spectroscopy) spectra of fluoropolymer films (SPTFE) deposited by rf (radio frequency) plasma sputtering of polytetrafluoroethylene (PTFE), using Ne, Kr and Xe as sputtering gases, were obtained and compared with prior spectra for SPTFE formed using He and Ar. The F/C (fluorine / carbon) ratios for SPTFE films (1.44-1.55), obtained at a rf power of 10 W, were essentially the same for all five rare gases, there being no trend of decreasing fluorine content in the SPTFE product with increasing atomic weight of the sputtering gas - contrary to the momentum transfer notion advanced by M. E. Ryan, et al. Increasing rf power from 10 to 50 W resulted in successively lower F/C ratios for SPTFE (e.g., from 1.55 to 1.21 in the case of Xe plasma-sputtered PTFE), accompanied by sputtering of the glass reactor and deposition of fragments of sodium aluminum silicate occurring at 40 W and above. In order to achieve a "Teflon-like" SPTFE structure (i.e., products with as high a F/C ratio as possible) in a given plasma reactor, an optimum rf power must be found, which in the present case was approximately 10 W.

Author

Polytetrafluoroethylene; Plasmas (Physics); Fluoropolymers; Sputtering; Rare Gases; Sodium Silicates; Aluminum Silicates; Radio Frequencies

20020069009 NASA Ames Research Center, Moffett Field, CA USA

XPS Study of Plasma- and Argon Ion-Sputtered Polytetrafluoroethylene

Golub, Morton A., NASA Ames Research Center, USA; [1997]; 1p; In English; Golden Gate Polymer Forum, 13 Nov. 1997, Mountain View, CA, USA

Contract(s)/Grant(s): RTOP 199-04-12-01; No Copyright; Avail: Issuing Activity; Abstract Only

The similarity of plasma-polymerized tetrafluoroethylene (PPTFE) and the fluoropolymer film deposited by rf (radio frequency) plasma sputtering (SPTFE) of polytetrafluoroethylene (PTFE), noted earlier in the literature, has been reconfirmed. FT-IR (Fourier Transform Infrared), XPS (X ray Photoelectron Spectroscopy) and UV (ultraviolet) spectroscopy has been employed in apparently the first study to involve preparation of PPTFE and SPTFE in the same reactor and under comparable low-power plasma conditions. Most of the work concerned the use of He or Ar as sputtering gas, but some runs were also carried out with the other rare gases Ne, Kr and Xe. The C1s XPS spectra of SPTFE films displayed a relatively higher content of CF₂ groups, and yielded higher F/C (fluorine / carbon) ratios, than PPTFE films, while the SPTFE films were somewhat more transparent in the UV than PPTFE. The F/C ratios for SPTFE were essentially independent of the rare gas used for sputtering. Increasing rf power from 10 to 50 W for Xe plasma-sputtering of PTFE resulted in successively lower F/C ratios (1.55 to 1.21), accompanied by sputtering of the glass reactor occurring at 40 W and above. Some limited XPS, FT-IR and UV data are presented on Ar ion-sputtered PTFE.

Author

Sputtering; Polytetrafluoroethylene; Photoelectron Spectroscopy; Fluoropolymers; Argon Plasma; Helium Plasma

20020070220 Georgia Inst. of Tech., School of Earth and Atmospheric Sciences, Atlanta, GA USA

Quantifying Silica Reactivity in Subsurface Environments: Reaction Affinity and Solute Matrix Controls on Quartz and SiO₂ Glass Dissolution Kinetics Final Report

Dove, P. M.; 2002; In English

Report No.(s): DE2002-791682; No Copyright; Avail: National Technical Information Service (NTIS)

During the three years of this project, Professor Dove's laboratory made tremendous progress in understanding controls on amorphous silica dissolution kinetics in aqueous solutions. Our findings have already received considerable attention. In hydrothermal and low temperature studies, the work focused on determining quantitative and mechanistic controls on the most abundant silica polymorphs in Earth environments--quartz and amorphous silica. Our studies achieved goals set forth in the original proposal to establish a new quantitative understanding of amorphous silica dissolution. This support has resulted in 10 journal, 12 abstracts and 2 thesis publications. The PI and students were also recognized with 6 awards during this period.

NTIS

Amorphous Materials; Quartz; Geochemistry; Glass

20020070222 Praxair, Inc., Tonawanda, NY USA

Ceramic Membrane Enabling Technology for Improved IGCC Efficiency Quarterly Report, 1 Jan. - 31 Mar. 2001

Prasad, R.; McMahon, T.; Apr. 2001; 10p; In English

Report No.(s): DE2002-793316; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This quarterly technical progress report will summarize work accomplished for Phase 1 Program during the quarter January to March 2001. In task 1 careful modification of the composition and processing conditions of the OTM has enabled manufacture of high quality OTM elements. In addition, finite element modeling has been used to identify a suitable composition and geometry

for successful pilot plant operation. In task 2, composite elements of materials with improved mechanical properties have been developed. In task 3, development of preferred fabrication methods has resulted in production of pilot plant scale composite elements. The work in task 4 has demonstrated that composite OTM elements can produce oxygen at atmospheric pressure of greater than 95% purity from a high-pressure air feed gas. The work in task 5 to construct a multi-tube OTM reactor is ongoing.

NTIS

Ceramics; Membranes; Compressed Gas; Atmospheric Pressure

20020070286 NASA Ames Research Center, Moffett Field, CA USA

Application of Pressure-Sensitive Paint to Rotorcraft

Schairer, Edward T., NASA Ames Research Center, USA; Hand, Lawrence A., NASA Ames Research Center, USA; Bell, James H., NASA Ames Research Center, USA; Mehta, Rabindra D., NASA Ames Research Center, USA; [1998]; 1p; In English; 6th Annual Pressure Sensitive Paint Workshop, 6-8 Oct. 1998, Renton, WA, USA

Contract(s)/Grant(s): RTOP 519-20-22; No Copyright; Avail: Issuing Activity; Abstract Only

In this presentation, a plan to develop methods for applying pressure-sensitive paint to rotorcraft will be described. These methods are needed because flows over rotor blades are typically very complex and poorly understood and because conventional methods for measuring unsteady pressures on rotor blades (using unsteady pressure transducers provide grossly inadequate spatial resolution. Since PSP is a surface, rather than a point, measurement technique, it has the potential to significantly increase the spatial resolution of pressure measurements on rotor blades. PSP techniques currently in use at Ames were developed for measuring steady pressures on rigid, complex airplane configurations in large, production wind tunnels. Applying PSP to rotorcraft requires a significant departure from these techniques. First and most importantly new, fast-responding and self-referencing pressure paints are required. The paints must be fast (98% response in 1-5 msec) to resolve flow unsteadiness; they must be self-referencing (or "binary") to account for changes in incident light intensity due to deflection of flexible rotors. Self-referencing paints have been used at Ames for some time; however, these paints have response times that are far too long for unsteady applications. Flash illumination is required to resolve flow unsteadiness and to minimize image blurring due to relative motion between the model and the camera. Current practice at Ames is to use continuous illumination. Finally, "in situ" paint calibration versus measurements by pressure transducers, which is current Ames practice, is not practical because of the difficulty and expense of installing transducers in rotor blades. Instead, the paint must be calibrated "a priori" in a calibration chamber. A sequence of five experiments that systematically isolates and addresses the problems involved in making PSP measurements on rotor blades has been planned. These are: (1) measurements on a rigid rotor in hover; (2) measurements on a flexible rotor in hover; measurements of paint response time in a calibration apparatus; (4) measurements on a rigid, two-dimensional oscillating airfoil; and (5) measurements on a flexible rotor in forward flight. Experiments were recently conducted at Ames where PSP measurements were made on a rigid oscillating airfoil (experiment type 4) and on a flexible rotor in hover (experiment type 2). Preliminary results from these experiments will be discussed.

Derived from text

Dynamic Pressure; Helicopters; Pressure Sensitive Paints; Pressure Measurement

20020070356 Argonne National Lab., Energy Technology Div., IL USA

Friction-Induced Structural Transformations of Diamondlike Carbon Coatings Under Various Atmospheres

Sanchez-Lopez, J. C.; Erdemir, A.; Donnet, C.; Rojas, T. C.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM; Prepared in cooperation by the Instituto de Ciencias de Materiales de Sevilla (Spain)

Report No.(s): DE2002-42516; No Copyright; Avail: National Technical Information Service (NTIS)

The structural transformations that occur in diamond like carbon coatings with increasing hydrogen content have been investigated by Raman spectroscopy, transmission electron microscopy, electron diffraction, and electron-energy-loss spectroscopy. Friction tests were performed with uncoated steel balls against coated substrates at contact stresses of 1 GPa in ambient air (relative humidity = 30 - 40%), dry air (relative humidity is less than 1%), and dry nitrogen (is less than 1%). The lowest friction coefficient (f is less than 0.02) was obtained for the most hydrogenated sample in dry nitrogen, where the formation of a third-body layer was observed on the steel surface. Raman spectra obtained from the counter faces after sliding in humid and dry air revealed a remarkable increase and narrowing of the 'D' and 'G' peaks with decreasing humidity. Analysis of peak positions and $I(D)/I(G)$ ratios pointed to an increasing order and an enlargement of the sp^2 clusters under friction. The shape and position of the carbon K-edge spectra for the transfer layer are affected the same way, although evidence of extended graphite layer

formation was not observed. Development of these differing trends was correlated with the hydrogen-to-carbon ratio of the gas precursor used during the synthesis and with the type of surrounding atmosphere.

NTIS

Carbon; Diamond Films; Environment Effects; Friction; Raman Spectroscopy; Metal Surfaces; Electron Diffraction; Energy Dissipation

20020070361 Praxair, Inc., Tonawanda, NY USA

Ceramic Membrane Enabling Technology for Improved IGCC Efficiency *Quarterly Report, Oct. - Dec. 2000*

Prasad, R.; McMahon, T.; Jan. 2001; 10p; In English

Report No.(s): DE2002-793311; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This quarterly technical progress report will summarize work accomplished for Phase 1 Program during the quarter October to December 2000. In task 1 careful modification of the processing conditions of the OTM has improved the properties of the final element. In addition, finite element modeling has been used to predict the mechanical behavior of OTM tubes and to identify strategies for improving OTM robustness. In task 2, composite elements of PSO1d have been prepared and tested for over 800 hours without degradation in oxygen flux. Alternative materials for composite OTM and architectures have been examined with success. In task 3, modification of fabrication routes has resulted in a substantial increase in the yield of PSO1d composite elements. The work in task 4 has demonstrated that composite OTM elements can produce oxygen at atmospheric pressure of greater than 95% purity from a high-pressure air feed gas. The work in task 5 to construct a multi-tube OTM reactor has begun.

NTIS

Ceramics; Compressed Gas; Mechanical Properties; Robustness (Mathematics); Atmospheric Pressure

20020070368 Jefferson (Thomas) Lab. Computer Center, Newport News, VA USA

Development of Cryogenically Microwave Lossy Ceramics with Adjustable Properties

Mikijelj, B.; Campisi, I.; 2002; 12p; In English

Report No.(s): DE2002-793445; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

At cryogenic temperatures (below 20 K), most of the existing lossy materials become non-lossy, requiring the development of a new materials effective in these conditions. Results of an effort to develop a cryogenically lossy materials based on the AlN matrix are presented in the paper. Hot pressing with a wide range of possible lossy second phases was tried, followed by complex permittivity measurements. A promising second phase was selected, produced and evaluated under cryogenic conditions at the Thomas Jefferson National Accelerator Facility (Jefferson Lab). The developed material system allows the dielectric permittivity to be varied depending on the application requirements.

NTIS

Ceramics; Cryogenic Temperature; Microwaves

20020070559 NASA Glenn Research Center, Cleveland, OH USA

Development of HVOF Sprayed Erosion/Oxidation Resistant Coatings for Composite Structural Components in Propulsion Systems

Knight, R., Drexel Univ., USA; Ivosevic, M., Drexel Univ., USA; Twardowski, T. E., Drexel Univ., USA; Kalidindi, S. R., Drexel Univ., USA; Sutter, James K., NASA Glenn Research Center, USA; Kim, D. Y., NASA Glenn Research Center, USA; [2002]; 28p; In English; High Temple Workshop XXII, 21-24 Jan. 2002, Santa Fe, NM, USA

Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thermally sprayed coatings are being studied and developed as methods of enabling lightweight composites to be used more extensively as structural components in propulsion applications in order to reduce costs and improve efficiency through weight reductions. The primary goal of this work is the development of functionally graded material [FGM] polymer/metal matrix composite coatings to provide improved erosion/oxidation resistance to polyimide-based polymer matrix composite [PMC] substrates. The goal is to grade the coating composition from pure polyimide, similar to the PMC substrate matrix on one side, to 100 % WC-Co on the other. Both step-wise and continuous gradation of the loading of the WC-Co reinforcing phase are being investigated. Details of the coating parameter development will be presented, specifically the high velocity oxy-fuel [HVOF] combustion spraying of pure PMR-11 matrix material and layers of various composition PMR-II/WC-Co blends onto steel and PMR-15 composite substrates. Results of the HVOF process optimization, microstructural characterization, and analysis will be presented. The sprayed coatings were evaluated using standard metallographic techniques - optical and scanning electron

microscopy [SEM]. An SEM + electron dispersive spectroscopy [EDS] technique has also been used to confirm retention of the PMR-II component. Results of peel/butt adhesion testing to determine adhesion will also be presented.

Author

Corrosion Resistance; Propulsion; HVOF Thermal Spraying; Microstructure; Sprayed Coatings

20020070584 Argonne National Lab., IL USA

Dense Ceramic Membranes for Hydrogen Separation

Balachandran, U.; Lee, T. H.; Wang, S.; Zhang, G.; Dorris, S. E.; Apr. 2002; 16p; In English

Report No.(s): DE2002-42971; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have developed cermet membranes that nongalvanically separate hydrogen from gas mixtures. The highest measured hydrogen flux was 20.0 cm³(STP)/min-cm² for an ANL-3a membrane at 900 C. For ANL-3 membranes with thickness of 40-500 (micro)m, hydrogen permeation is limited by the bulk diffusion of hydrogen through the metal phase. The effect of hydrogen partial pressure on permeation rate confirmed this conclusion, suggesting that higher permeation rates may be obtained by decreasing the membrane thickness. Permeation rate in a syngas atmosphere for times up to 190 h showed no degradation in performance, which indicates that ANL-3 membranes may be suitable for long-term, practical hydrogen separation.

NTIS

Ceramics; Membranes; Hydrogen; Gas Mixtures; Gas Pressure; Pressure Effects

20020070610 NASA Glenn Research Center, Cleveland, OH USA

The Effect of Heating on the Degradation of Ground Laboratory and Space Irradiated Teflon(R) FEP

deGroh, Kim K., NASA Glenn Research Center, USA; Martin, Morgana, Ohio Aerospace Inst., USA; July 2002; 17p; In English; Sixth International Conference on Protection of Materials and Structures From Space Environment, 1-3 May 2002, Toronto, Canada; Sponsored by Toronto Univ., Canada

Contract(s)/Grant(s): RTOP 755-A4-06

Report No.(s): NASA/TM-2002-211704; E-13449; NAS 1.15:211704; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The outer most layer of the multilayer insulation (MLI) blankets on the Hubble Space Telescope (HST) is back surface aluminized Teflon(R) FEP (fluorinated ethylene propylene). As seen by data collected after each of the three servicing missions and as observed during the second servicing mission (SM2), the FEP has become embrittled in the space environment, leading to degradation of the mechanical properties and severe on-orbit cracking of the FEP. During SM2, a sample of aluminized-FEP was retrieved from HST that had cracked and curled, exposing its aluminum backside to space. Because of the difference in optical properties between FEP and aluminum, this insulation piece reached 200 C on-orbit, which is significantly higher than the nominal MLI temperature extreme of 50 C. This piece was more brittle than other retrieved material from the first and third servicing missions (SM1 and SM3A, respectively). Due to this observation and the fact that Teflon thermal shields on the solar array bi-stems were heated on-orbit to 130 C, experiments have been conducted to determine the effect of heating on the degradation of FEP that has been irradiated in a ground laboratory facility or in space on HST. Teflon FEP samples were X-ray irradiated in a high vacuum facility in order to simulate the damage caused by radiation in the space environment. Samples of pristine FEP, X-ray irradiated FEP and FEP retrieved from the HST during SM3A were heat treated from 50 to 200 C at 25 intervals in a high vacuum facility and then tensile tested. In addition, samples were tested in a density gradient column to determine the effect of the radiation and heating on the density of FEP. Results indicate that although heating does not degrade the tensile properties of non-irradiated Teflon, there is a significant dependence of the percent elongation at failure of irradiated Teflon as a function of heating temperature. Irradiated Teflon was found to undergo increasing degradation in the elongation at failure as temperature was increased from room temperature to 200 C. Rate of degradation changes, which were consistent with the glass transition temperatures for FEP, appeared to be present in both tensile and density data. The results indicate the significance of the on-orbit temperature of Teflon FEP with respect to its degradation in the low Earth orbital space environment.

Author

Aluminum; Damage; Degradation; Failure; Heat Shielding; Mechanical Properties; Multilayer Insulation; Teflon (Trademark); Temperature Effects

20020070613 Ohio Aerospace Inst., Cleveland, OH USA

Morphological Evolution and Weak Interface Development within CVD-Zirconia Coating Deposited on Hi-Nicalon Fiber

Li, Hao, Stevens Inst. of Tech., USA; Lee, Jinil, Stevens Inst. of Tech., USA; Libera, Matthew R., Stevens Inst. of Tech., USA; Lee, Woo Y., Stevens Inst. of Tech., USA; Kebbede, Anteneh, General Electric Co., USA; Lance, Michael J., Oak Ridge National

Lab., USA; Wang, Hongyu, General Electric Co., USA; Morscher, Gregory N., Ohio Aerospace Inst., USA; [2002]; 28p; In English

Contract(s)/Grant(s): NCC3-763; NSF DMR-99-71623; RTOP 708-73-27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The phase contents and morphology of a ZrO₂ fiber coating deposited at 1050 C on Hi-Nicalon(Tm) by chemical vapor deposition were examined as a function of deposition time from 5 to 120 min. The morphological evolution in the ZrO₂ coating was correlated to the development of delamination within the ZrO₂ coating. The delamination appears to occur as a result of: (1) continuous formation of tetragonal ZrO₂ nuclei on the deposition surface; (2) martensitic transformation of the tetragonal phase to a monoclinic phase upon reaching a critical grain size; and (3) development of significant compressive hoop stresses due to the volume dilation associated with the transformation. Our observations suggest that it will be of critical importance to further understand and eventually control the nucleation and grain growth behavior of CVD ZrO₂ and its phase transformation behavior for its potential applications for composites.

Author

Zirconium Oxides; Fiber Composites; Coating; Vapor Deposition

20020070656 NASA Lewis Research Center, Cleveland, OH USA

Enhancement of Perfluoropolyether Boundary Lubrication Performance, 1, Preliminary Results

Jones, W. R., Jr., NASA Lewis Research Center, USA; Ajayi, O. O., Wedeven Associates, Inc., USA; Goodell, A. J., Wedeven Associates, Inc., USA; Wedeven, L. D., Wedeven Associates, Inc., USA; Devine, E., Swales and Associates, USA; Predmore, R. E., NASA Goddard Space Flight Center, USA; June 1995; 12p; In English; 207th National Meeting, 13-18 Mar. 1994, San Diego, CA, USA; Sponsored by American Chemical Society, USA

Contract(s)/Grant(s): RTOP 233-02-0D

Report No.(s): NASA-TM-106937; E-9665; NAS 1.15:106937; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A ball bearing simulator operating under starved conditions was used to evaluate the boundary lubrication performance of a perfluoropolyether (PFPE), Krytox 143 AB. Several approaches to enhance boundary lubrication were studied. These included: (1) soluble boundary additives, (2) bearing surface modifications, (3) "run-in" surface films and (4) ceramic bearing components. In addition, results were compared with two non-perfluorinated liquid lubricant formulations. Based on these preliminary tests, the following tentative conclusions can be made: (1) Substantial improvements in boundary lubrication performance were observed with a beta-diketone boundary additive and a tricresyl phosphate (TCP) liquid surface pretreatment, (2) the use of rough Si₃N₄ balls (Ra = 40 microns) also provided substantial improvement but with concomitant abrasive wear, (3) marginal improvements were seen with two boundary additives (a phosphine and a phosphotriazine) and a neat (100%) fluid (a carboxylic acid terminated PFPE); and surface pretreatments with synthetic hydrocarbons, a PTFE coating, and TiC coated 440 C and smooth Si₃N₄ balls (Ra less than 1 microns), and (4) two non-PFPE lubricant formulations (a PAO and a synthetic hydrocarbon) yielded substantial improvements.

Author

Boundary Lubrication; Carboxylic Acids; Coating; Hydrocarbons; Lubricants; Polytetrafluoroethylene

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PROPELLANTS AND FUELS

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

20020068998 Virginia Polytechnic Inst. and State Univ., Dept. of Chemistry, Blacksburg, VA USA

Computational Thermochemistry of Jet Fuels and Rocket Propellants

Crawford, T. Daniel, Virginia Polytechnic Inst. and State Univ., USA; [2002]; 3p; In English

Contract(s)/Grant(s): NAG3-2796; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The design of new high-energy density molecules as candidates for jet and rocket fuels is an important goal of modern chemical thermodynamics. The NASA Glenn Research Center is home to a database of thermodynamic data for over 2000 compounds related to this goal, in the form of least-squares fits of heat capacities, enthalpies, and entropies as functions of temperature over the range of 300 - 6000 K. The chemical equilibrium with applications (CEA) program written and maintained by researchers at NASA Glenn over the last fifty years, makes use of this database for modeling the performance of potential rocket propellants. During its long history, the NASA Glenn database has been developed based on experimental results and data

published in the scientific literature such as the standard JANAF tables. The recent development of efficient computational techniques based on quantum chemical methods provides an alternative source of information for expansion of such databases. For example, it is now possible to model dissociation or combustion reactions of small molecules to high accuracy using techniques such as coupled cluster theory or density functional theory. Unfortunately, the current applicability of reliable computational models is limited to relatively small molecules containing only around a dozen (non-hydrogen) atoms. We propose to extend the applicability of coupled cluster theory- often referred to as the 'gold standard' of quantum chemical methods- to molecules containing 30-50 non-hydrogen atoms. The centerpiece of this work is the concept of local correlation, in which the description of the electron interactions- known as electron correlation effects- are reduced to only their most important localized components. Such an advance has the potential to greatly expand the current reach of computational thermochemistry and thus to have a significant impact on the theoretical study of jet and rocket propellants.

Author

Thermochemistry; Mathematical Models; Jet Engine Fuels; Rocket Propellants; Electron Scattering; Quantum Chemistry; Computational Chemistry; Thermodynamics

20020070212 Air Products and Chemicals, Inc., Allentown, PA USA

Alternative Fuels and Chemicals from Synthesis Gas. Technical Progress Report No. 21 Progress Report, 1 Oct. - 31 Dec. 1999

2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794367; No Copyright; Avail: National Technical Information Service (NTIS)

The overall objectives of this program are to investigate potential technologies for the conversion of synthesis gas to oxygenated and hydrocarbon fuels and industrial chemicals, and to demonstrate the most promising technologies at DOE's LaPorte, Texas, Slurry Phase Alternative Fuels Development Unit (AFDU). The program will involve a continuation of the work performed under the Alternative Fuels from Coal-Derived Synthesis Gas Program and will draw upon information and technologies generated in parallel current and future DOE-funded contracts.

NTIS

Hydrocarbons; Synthesis Gas; Hydrocarbon Fuels; Coal Derived Gases

20020070362 Pennsylvania State Univ., University Park, PA USA

Deep Desulfurization of Diesel Fuels by a Novel Integrated Approach Semiannual Report, 1 Mar. - 31 Aug. 2001

Ma, X.; Sun, L.; Song, C.; Sep. 2001; 32p; In English

Report No.(s): DE2002-793305; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Due to the increasingly stricter regulations for deep reduction of fuel sulfur content, development of new deep desulfurization processes for liquid transport fuels has become one of the major challenges to the refining industry and to the production of hydrocarbon fuels for fuel cell applications. The sulfur compounds in the current transport fuels corresponding to the S level of 350-500 ppm account for only about 0.12-0.25 wt % of the fuel. The conventional hydrotreating approaches will need to increase catalyst bed volume at high-temperature and high-pressure conditions for treating 100 % of the whole fuel in order to convert the fuel mass of less than 0.25 wt %. In the present study, we are exploring a novel adsorption process for desulfurization at low temperatures, which can effectively reduce the sulfur content in gasoline, jet fuel and diesel fuel at low investment and operating cost to meet the needs for ultra-clean transportation fuels and for fuel cell applications. Some adsorbents were prepared in this study for selective adsorption of sulfur compounds in the fuels. The adsorption experiments were conducted by using a model fuel and real fuels. The results show that the adsorbent (A-1) with a transition metal compound has a significant selectivity for sulfur compounds with a saturated adsorption capacity of (approx)0.12 mol of sulfur compounds per mol of the metal compound. Most sulfur compounds existing in the current commercial gasoline, jet fuel and diesel fuel can be removed by the adsorption using adsorbent A-1. On the basis of the preliminary results, a novel concept for integrated process for deep desulfurization of liquid hydrocarbons was proposed.

NTIS

Diesel Fuels; Desulfurizing

20020070369 Department of Energy, National Petroleum Technology Office, Tulsa, OK USA

Assistance to Oil and Gas State Agencies and Industry Through Continuation of Environmental and Production Data Management and a Water Regulatory Initiative Final Report, 1 Oct. 1998 - 30 Sep. 2001

Grunewald, B.; Arthur, D.; Langhus, B.; Gillespie, T.; Binder, B.; May 2002; 316p; In English

Report No.(s): DE2002-794997; DOE/BC/15141-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This grant project was a major step toward completion of the Risk Based Data Management System (RBDMS) project. Additionally the project addresses the needs identified during the project's initial phases. by implementing this project, the following outcomes were sought: (1) State regulatory agencies implemented more formalized environmental risk management practices as they pertain to the production of oil and gas, and injection via Class II wells; (2) Enhancement of oil and gas production by implementing a management system supporting the saving of abandoned or idle wells located in areas with a relatively low environmental risk of endangering underground sources of drinking water (USDWs) in a particular state; (3) Verification that protection of USDWs is adequate and additional restrictions of requirements are not necessary in areas with a relatively low environmental risk; (4) Standardization of data and information maintained by state regulatory agencies and decrease the regulatory cost burden on producers operating in multiple states, and (5) Development of a system for electronic data transfer among operators and state regulatory agencies and reduction of overall operator reporting burdens.

NTIS

Environment Management; Management Systems; Production Management; Gas Injection

20020070379 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA

An Investigation of Applications for Thermodynamic Work Potential Methods: Working Tables and Charts for Estimation of Thermodynamic Work Potential in Equilibrium Mixtures of Jet-A and Air Final Report, 1 Mar. 2001 - 30 Jun. 2002

Mavris, Dimitri, Georgia Inst. of Tech., USA; Roth, Bryce, Georgia Inst. of Tech., USA; McDonald, Rob, Georgia Inst. of Tech., USA; Jun. 18, 2002; 72p; In English

Contract(s)/Grant(s): NAG3-2586

Report No.(s): E-16-T42; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this report is to provide a tool to facilitate the application of thermodynamic work potential methods to aircraft and engine analysis. This starts with a discussion of the theoretical background underlying these methods, which is then used to derive various equations useful for thermodynamic analysis of aircraft engines. The work potential analysis method is implemented in the form of a set of working charts and tables that can be used to graphically evaluate work potential stored in high-enthalpy gas. The range of validity for these tables is 300 to 36,000 R, pressures between between 0.01 atm and 100 atm, and fuel-air ratios from zero to stoichiometric. The derivations and charts assume mixtures of Jet-A and air as the working fluid. The thermodynamic properties presented in these charts were calculated based upon standard thermodynamic curve fits.

Author

Aircraft Fuels; Thermodynamic Properties; Potential Energy; Thermodynamic Equilibrium; Jet Engine Fuels

20020070577 Membrane Technology and Research, Inc., Menlo Park, CA USA

Field Demonstration of a Membrane Process to Recover Heavy Hydrocarbons and to Remove Water from Natural Gas. Report Ending September 29, 2001 Annual Report

Baker, R. W.; Hofmann, T.; Kaschemekat, J.; Lokhandwala, K. A.; Apr. 10, 2002; 16p; In English

Report No.(s): DE2002-794129; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this project is to design, construct and field demonstrate a 3-MMscfd membrane system to recover natural gas liquids (NGL) and remove water from raw natural gas. The gas processed by the membrane system will meet pipeline specifications for dew point and Btu value, and the process is likely to be significantly less expensive than glycol dehydration followed by propane refrigeration, the principal competitive technology. The BP-Amoco gas processing plant in Pascagoula, MS was finalized as the location for the field demonstration. Detailed drawings of the MTR membrane skid (already constructed) were submitted to the plant in February, 2000. However, problems in reaching an agreement on the specifications of the system compressor delayed the project significantly, so MTR requested (and was subsequently granted) a no-cost extension to the project. Following resolution of the compressor issues, the goal is to order the compressor during the first quarter of 2002, and to start field tests in mid-2002. Information from potential users of the membrane separation process in the natural gas processing industry suggests that applications such as fuel gas conditioning and wellhead gas processing are the most promising initial targets. Therefore, most of our commercialization effort is focused on promoting these applications. Requests for stream evaluations and for design and price quotations have been received through MTR's web site, from direct contact with potential users, and through announcements in industry publications. to date, about 90 commercial quotes have been supplied, and orders totaling about \$1.13 million for equipment or rental of membrane units have been received.

NTIS

Hydrocarbons; Membranes; Natural Gas

20020070679 Helsinki Univ. of Technology, Espoo Finland

Fluidised Bed Combustion and Gasification. Espoo, Finland 31.10.-2.11.2001

Zevenhoven, R.; Oct. 2001; 220p; In English

Report No.(s): PB2002-105018; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This volume contains the material supporting the lectures during the post-graduate course Ene-47.200/200, fluidized bed combustion and gasification in Espoo, Finland, October 31-November 2, 2001. Almost 40 participants from Finland, Sweden, Denmark, Latvia and Lithuania attend the 16 lectures by 5 invited speakers. In addition, a few post-graduate students briefly presented some of their work related to the field of fluidized bed combustion/gasification.

NTIS

Combustion; Coal Gasification; Fluidized Bed Processors

29

SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.

20020067783 NASA Marshall Space Flight Center, Huntsville, AL USA

Equilibrium Kinetics Studies and Crystallization Aboard the International Space Station (ISS) Using the Protein Crystallization Apparatus for Microgravity (PCAM)

Achari, Aniruddha, Raytheon Co., USA; Roeber, Dana F., Universities Space Research Association, USA; Barnes, Cindy L., Universities Space Research Association, USA; Kundrot, Craig E., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; American Crystallographic Association Annual Meeting, 25-30 May 2002, San Antonio, TX, USA; Sponsored by American Crystallographic Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Protein Crystallization Apparatus in Microgravity (PCAM) trays have been used in Shuttle missions to crystallize proteins in a microgravity environment. The crystallization experiments are 'sitting drops' similar to that in Cryschem trays, but the reservoir solution is soaked in a wick. From early 2001, crystallization experiments are conducted on the International Space Station using mission durations of months rather than two weeks on previous shuttle missions. Experiments were set up in April 2001 on Flight 6A to characterize the time crystallization experiments will take to reach equilibrium in a microgravity environment using salts, polyethylene glycols and an organic solvent as precipitants. The experiments were set up to gather data for a series of days of activation with different droplet volumes and precipitants. The experimental set up on ISS and results of this study will be presented. These results will help future users of PCAM to choose precipitants to optimize crystallization conditions for their target macromolecules for a particular mission with known mission duration. Changes in crystal morphology and size between the ground and space grown crystals of a protein and a protein-DNA complex flown on the same mission will also be presented.

Author

Crystallization; International Space Station; Kinetics; Macromolecules; Microgravity; Protein Crystal Growth

20020068101 Alabama Univ., Huntsville, AL USA

Ultrasonic Characterization of Fatigue Cracks in Composite Materials

Workman, Gary L., Alabama Univ., USA; Watson, Jason, Alabama Univ., USA; Johnson, Devin, Alabama Univ., USA; Walker, James, NASA Marshall Space Flight Center, USA; Russell, Sam, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 11th International Symposium on Nondestructive Characterization of Materials, 24-28 Jun. 2002, Berlin, Germany Contract(s)/Grant(s): NAG8-1548; No Copyright; Avail: Issuing Activity; Abstract Only

Microcracking in composite structures due to combined fatigue and cryogenic loading can cause leakage and failure of the structure and can be difficult to detect in-service. In aerospace systems, these leaks may lead to loss of pressure/propellant, increased risk of explosion and possible cryo-pumping. The success of nondestructive evaluation to detect intra-ply microcracking in unlined pressure vessels fabricated from composite materials is critical to the use of composite structures in future space systems. The work presented herein characterizes measurements of intraply fatigue cracking through the thickness of laminated composite material by means of correlation with ultrasonic resonance. Resonant ultrasound spectroscopy provides measurements which are sensitive to both the microscopic and macroscopic properties of the test article. Elastic moduli, acoustic attenuation, and geometry can all be probed. The approach is based on the premise of half-wavelength resonance. The method injects a broadband ultrasonic wave into the test structure using a swept frequency technique. This method provides dramatically

increased energy input into the test article, as compared to conventional pulsed ultrasonics. This relative energy increase improves the ability to measure finer details in the materials characterization, such as microcracking and porosity. As the microcrack density increases, more interactions occur with the higher frequency (small wavelength) components of the signal train causing the spectrum to shift toward lower frequencies. Several methods are under investigation to correlate the degree of microcracking from resonance ultrasound measurements on composite test articles including self organizing neural networks, chemometric techniques used in optical spectroscopy and other clustering algorithms.

Author

Algorithms; Composite Materials; Fatigue (Materials); Ultrasonic Radiation; Ultrasonics; Microcracks

20020068459 NASA Marshall Space Flight Center, Huntsville, AL USA

Viscosity Measurement Using Drop Coalescence in Microgravity

Antar, Basil N., Tennessee Univ. Space Inst., USA; Ethridge, Edwin C., NASA Marshall Space Flight Center, USA; Maxwell, Daniel, Tennessee Univ. Space Inst., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We present in here validation studies of a new method for application in microgravity environment which measures the viscosity of highly viscous undercooled liquids using drop coalescence. The method has the advantage of avoiding heterogeneous nucleation at container walls caused by crystallization of undercooled liquids during processing. Homogeneous nucleation can also be avoided due to the rapidity of the measurement using this method. The technique relies on measurements from experiments conducted in near zero gravity environment as well as highly accurate analytical formulation for the coalescence process. The viscosity of the liquid is determined by allowing the computed free surface shape relaxation time to be adjusted in response to the measured free surface velocity for two coalescing drops. Results are presented from two sets of validation experiments for the method which were conducted on board aircraft flying parabolic trajectories. In these tests the viscosity of a highly viscous liquid, namely glycerin, was determined at different temperatures using the drop coalescence method described in here. The experiments measured the free surface velocity of two glycerin drops coalescing under the action of surface tension alone in low gravity environment using high speed photography. The liquid viscosity was determined by adjusting the computed free surface velocity values to the measured experimental data. The results of these experiments were found to agree reasonably well with the known viscosity for the test liquid used.

Author

Coalescing; Viscosity; Viscous Flow; Viscometry; Microgravity; Surface Reactions

31

ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.

20020068004 NASA Marshall Space Flight Center, Huntsville, AL USA

AMSD Cryo Actuator Testing

Mullette, Mark, NASA Marshall Space Flight Center, USA; Matthews, Gary, Eastman Kodak Co., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-00148; No Copyright; Avail: Issuing Activity; Abstract Only

The actuator technology required for AMSD and subsequently NGST are critical in the successful development for future cryogenic systems. Kodak has undertaken an extensive test plan to determine the performance of the force actuators developed under the AMSD program. These actuators are currently in testing at MSFC and are expected to finish this test cycle in early June 2002.

Author

Actuators; Cryogenics; Performance Tests

20020068105 Eastman Kodak Co., Rochester, NY USA

Kodak AMSD Cryogenic Test Plans

Matthews, Gary, Eastman Kodak Co., USA; Hammon, John, Eastman Kodak Co., USA; Barrett, David, Eastman Kodak Co., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-00148; No Copyright; Avail: Issuing Activity; Abstract Only

NGST will be an IR based optical system that will operate at cryogenic temperatures. As part of the AMSD program, Kodak must demonstrate the ability of our system to perform at these very cold temperatures. Kodak will discuss the test approach that will be used for cryogenic testing at MSFC's XRCF.

Author

Infrared Instruments; Optical Equipment; Performance Tests; Cryogenics

20020068808 Alabama Univ., Dept. of Physics, Huntsville, AL USA

Ion Milling of Sapphire

Gregory, Don A., Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XVII-1 - XVII-7; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The ion figuring system at the Marshall Space Flight Center has been successfully used for at least three previous investigations into the ion milling of metals. The research was directed toward improving the surface quality of X-ray directing optics. These studies were performed on surfaces that were already hand polished to an excellent surface quality and were intended to remove the residual unwanted figure left by those techniques. The ion milling was typically carried out on test surfaces or mandrels that were several centimeters in width and length. The good thermal conductivity of the metal samples allowed the ion beam to be directed onto the sample for an indefinite period of time. This is not true of sapphire or most electrical insulators and problems have arisen in recent attempts to ion mill thin samples of sapphire. The failure and fracture of the material was likely due to thermal stresses and the relatively low thermal conductivity of sapphire (compared to most metals). These assumed stresses actually provided the key as to how they might be monitored. A thermal gradient in the sapphire sample will induce an effective index of refraction change and because of the shape constraint and the crystal structure and simple thermal expansion, this index change will be nonuniform across the sample. In all but simple cubic crystal structures, this leads to a spatially nonuniform optical retardance induced on any polarized optical beam traversing the sample, and it is this retardance that can be monitored using standard polarimetric procedures.

Author

Ion Beams; Crystal Optics; Ion Optics; X Ray Optics; Milling (Machining); Sapphire; Optimization

20020070205 Sterling Software, Inc., USA

Graphics for Stereo Visualization Theater for Supercomputing 1998

Antipuesto, Joel, Sterling Software, Inc., USA; [1998]; 1p; In English

Contract(s)/Grant(s): NAS2-13619; RTOP 519-40-62; No Copyright; Avail: Issuing Activity; Abstract Only

The Stereo Visualization Theater is a high-resolution graphics demonstration that prides a review of current research being performed at NASA. Using a stereoscopic projection, multiple participants can explore scientific data in new ways. The pre-processed audio and video are being played in real-time off of a workstation. A stereo graphics filter for the projector and passive polarized glasses worn by audience members are used to create the stereo effect.

Author

High Resolution; Supercomputers; Projectors

20020070365 Ohio State Univ., Columbus, OH USA

Prediction of Part Distortion in Die Casting

Miller, A.; Feb. 12, 2002; In English

Report No.(s): DE2002-793689; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this research was to predict the part deformation after complete cooling. A finite element model was built to achieve this goal and several modeling techniques were investigated throughout this research. Some important points were concluded and needs to be stated. The results from research show the importance of some modeling factors used to represent the die casting process in a simulation. The most important factor is the material model used to describe the casting. In this research three material models were investigated. These are elastic, elasto-plastic and elasto-viscoplastic. The results showed very significant difference in the predicted distortion and residual stresses among the three models. The research shows also the lack of data for Al380. This includes the creep properties, plasticity properties; yield strength and modulus of elasticity at high temperatures. Using the exact properties in the model is very important in order to get the required accurate results. The results showed also that the criteria to model some of the machine parts, namely, tie bars and toggle system do not affect the results. The researcher might select the best method to fit his finite element package and to allow results as fast as possible.

NTIS

Casting; Computerized Simulation; Components; Distortion; Creep Properties; Deformation; Elastoplasticity; Viscoplasticity

32 COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.

20020067723 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

Chaotic Sea Clutter Returns. Current Status and Application to Airborne Radar Systems

McDonald, Michael K.; Nov. 2001; 70p; In English; Original contains color images

Report No.(s): AD-A403862; DREO-TR-2001-114; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The potential to model sea clutter radar returns using chaos theory is examined. Chaotic systems display qualitative similarities to sea clutter returns such as broad flat spectrums, boundedness and irregular temporal behaviour. In this report several key parameters of chaotic systems, namely correlation dimension, Lyapunov spectrum and Lyapunov dimension are calculated from real sea clutter returns and found to be consistent with a chaotic interpretation. The airborne high resolution data (less than one metre) produces a correlation coefficient with an average value of 4.63 and an embedding dimension of 6-7. Lyapunov dimensions are consistent with correlation values. A local linear technique and a radial basis function (RBF) are used to construct a one step non-linear predictor. A Mean Square Error (MSE) of approximately 0.0032 between the predicted and normalized (i.e.; maximum +/- 1 range) real time series is measured. If sea clutter is in fact, a chaotic system, then it may be possible to accurately predict sea clutter returns via a non-linear chaotic model and produce substantial improvements in the small target detection capabilities of the APS-506 radar on the CP-140 maritime patrol aircraft.

DTIC

Chaos; Time Series Analysis; Correlation Coefficients; Airborne Radar; Liapunov Functions

20020067769 Naval Research Lab., Washington, DC USA

Analysis of Experimental Data From a Scaled Ocean-Surveillance Radar

Hemenway, D. F.; Mar. 07, 1972; 77p; In English

Report No.(s): AD-A403801; NRL-7388; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To validate various theoretical models used in the design and specification of a proposed satellite-borne, ship-detection, ocean-surveillance radar, an airborne test-bed radar system has been developed and used to acquire experimental data. The major operating and performance parameters of the test-bed radar are either identical to or are scaled to the equivalent parameters of the satellite sensor. The analysis of experimental data acquired with the test-bed radar indicates that the satellite radar system should meet the objective of automatically detecting ship targets with radar cross sections equal to or greater than 200 square meters. The analysis of the experimental data covers a variety of ships, ship aspects, ship lengths, sea states, and grazing angles. All of the ship-target data analyzed resulted in measures of processed-radar-video signal/(clutter plus noise) ratios ($S/(C + N)$) greater than 16 dB. The same data normalized for a satellite sensor system indicates that the 16 dB $S/(C + N)$ required for automatic detection would be realized for 200-square-meter ship targets. The experimental data confirm that for the 0.016 seconds inter-pulse time period the sea clutter is for practical purposes completely decorrelated.

DTIC

Airborne Radar; Surveillance Radar; Data Systems; Oceans

20020068020 Department of Defense, Office of the Inspector General, Arlington, VA USA

Information Technology: Global Command and Control System Readiness Assessment System Output Tool

Jul. 24, 2002; 82p; In English; Original contains color images

Report No.(s): AD-A404046; IG/DOD-D-2002-133; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report should be read by the Global Command and Control System (GCCS) requirements developers, program implementers, functional proponents, and readiness users who rely on them. The report discusses the development and fielding of a GCCS candidate solution for the readiness functional area. This is the second in a series of reports the Inspector General of the Department of Defense is issuing on the policies and procedures that govern the GCCS. The GCCS is the DoD joint command and control system designed to provide the military leadership with tools to plan and execute worldwide joint military operations. The Readiness Assessment System Output Tool is a GCCS application designed to fulfill both Service and combatant command readiness assessment requirements at the tactical, operational, and strategic levels.

DTIC

Command and Control; Information Systems

20020068032 Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA
Signal to Noise Ratio Improvement Using Wavelet and Frequency Domain Based Processing *Final Report, Mar.-Dec. 2001*
Hippenstiel, R.; May 24, 2002; 55p; In English
Contract(s)/Grant(s): MIPR-B448212

Report No.(s): AD-A404025; NPS-EC-02-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This work investigates the use of wavelet and FFT based decompositions to improve the signal to noise ratio of noisy signals. In their respective transform domains, median filtering or predictive filtering is employed. Prior to the decompositions a short time domain median filter is used. As a benchmark, only a median time domain filter (order 3) is used and for part of the work the pre-filtering is disabled. Three test signals are used: two frequency chirped signals and a Barker coded BPSK signal. The most effective processing sequence for the chirp signals is median filtering, followed by FFT processing, which in turn, is followed by median filtering of the FFT transform coefficients. For the BPSK signal, the time domain median filter provided the best results.

DTIC

Signal to Noise Ratios; Signal Processing; Binary Phase Shift Keying; Wavelet Analysis; Fast Fourier Transformations

20020068078 Naval Research Lab., Washington, DC USA
Systems Aspects of Digital Beam Forming Ubiquitous Radar

Skolnik, Merrill; Jun. 28, 2002; 43p; In English

Report No.(s): AD-A403877; NRL/MR/5007--02-8625; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the general characteristics and potential capabilities of digital beam forming (DBF) ubiquitous radar, one that looks everywhere all the time. In a ubiquitous radar, the receiving antenna consists of a number of fixed contiguous high-gain beams that cover the same region as a fixed low-gain (quasi-omnidirectional) transmitting antenna. The ubiquitous radar is quite different from the mechanically rotating-antenna radar or the conventional multifunction phased array radar in that it can carry out multiple functions simultaneously rather than sequentially. Thus it has the important advantage that its various functions do not have to be performed in sequence one at a time, something that is a serious limitation of conventional phased arrays. A radar that looks everywhere all the time uses long integration times with many pulses, which allows better shaping of Doppler filters for better MTI or pulse Doppler processing. The DBF ubiquitous radar is a new method for achieving important radar capabilities not readily available with current radar architectures.

DTIC

Digital Radar Systems; Omnidirectional Antennas; Beamforming; Radar Antennas

20020068083 Joint Chiefs of Staff, Washington, DC USA
Joint Multi-Tactical Digital Information Link (TADIL) Operating Procedures

Mar. 01, 2000; 641p; In English

Report No.(s): AD-A404022; CJCSM-6120.01B; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This manual provides planning guidance and operating procedures to U.S. forces for the employment of tactical data systems that exchange real-time or near real-time information through the use of a tactical digital information link (TADIL),

DTIC

Digital Systems; Data Links; Digital Data; Data Systems

20020068091 Corps of Engineers, Washington, DC USA
Plant: Radio Frequency and Call Sign Assignments

Sep. 15, 1986; 15p; In English

Report No.(s): AD-A404085; ER-1125-2-308; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This regulation prescribes procedures to be followed for submitting requests for radio frequency, ship radio authorizations (SKA) , and cases of harmful interference.

DTIC

Communication Equipment; Radio Frequencies

20020068713 Defence Science and Technology Organisation, Electronics and Surveillance Research, Salisbury, Australia
Demand Moderation in Military Communication Networks

Blackmore, Perry A.; Apr. 2002; 29p; In English

Report No.(s): AD-A403922; DSTO-TR-1286; DODA-AR-012-176; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interconnected heterogeneous networks with diverse ownership, carrying a wide range of multimedia traffic with extreme variations in load will characterise military networks of the future. Consequently, the design of a management and control architecture, which fosters efficient and military-tailored resource sharing, is a challenging multifaceted problem. A key feature of such an architecture is to give the network the ability to deliver meaningful signals to users in order for them to modify their behaviour in a way that is beneficial to the network as a whole. For example, during times of network stress, users should be discouraged from excessive network usage. Demand moderation is the term used to encompass the array of mechanisms aimed at achieving this end. Integrated Defence networks of the future should benefit enormously from demand moderation mechanisms.

DTIC

Armed Forces; Heterogeneity; Communication Networks

20020068892 Northrop Grumman Corp., Electronic Sensors and Systems Div., Baltimore, MD USA

Modular Digital Radio Frequency (RF) Receiver System (MODRFS) Program. System Architecture Definition Report Final Report, 18 Nov. 1998-1 Jun. 1999

Hageman, Michael; Jun. 1999; 34p; In English

Contract(s)/Grant(s): F33615-98-2-1331; Proj-2735

Report No.(s): AD-A403917; AFRL-SN-WP-TR-2002-1056; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the top-level MODRFS (Modular Digital Radio Frequency (RF) Receiver System) architecture. The architecture study began by identifying those particular missions, weapons systems, and sensor systems consistent with current and emerging Northrop Grumman ESSS (Engineering Simulation and Scientific Software) products. Receiver functional and performance requirements for each of these applications were compiled in a common tabular format. From these, a baseline set of performance objectives was chosen to span the widest set of applications and modes. A baseline modular receiver architecture was generated to meet these common requirements. The functionality and interface descriptions for the resulting modular building objects (MBOs) are provided in this report.

DTIC

Digital Systems; Radio Receivers; Radio Frequencies

20020068908 Space and Naval Warfare Systems Center, San Diego, CA USA

Accomplishment Report for Fiscal Year 2001 Final Report, Oct. 2000-Sep. 2001

Apr. 2002; 57p; In English; Original contains color images

Report No.(s): AD-A403899; SSC/SD-TD-3137; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

SSC San Diego C4I (Command, Control, Communications, Computer and Intelligence) Programs Office Philadelphia is responsible for a program of development, in-service engineering, procurement, installation support, configuration control, and integrated logistics support for shipboard and shore-based C4I systems, mission planning systems, and electronic photographic processing systems. SSC San Diego C4I Programs Office Philadelphia provides technical support for the Naval Air Systems Command, Naval Electronic Logistics Office, Naval Sea Systems Command (PMS-312/PMS-377), and the National Imagery and Mapping Agency. Headed by a civilian manager, SSC San Diego C4I Programs Office Philadelphia comprises 64 civilians including engineers, computer specialists, intelligence operations specialists, technicians, logisticians, and management support personnel, practicing total quality management and ensuring the quality process is routinely used. Engineering and technical support is provided by 180 contractor personnel. This report describes technical accomplishments and cites awards and recognition received by SSC San Diego C4I Programs Office Philadelphia during fiscal year 2001.

DTIC

Command and Control; Logistics Management; Communication; Armed Forces (USA); Military Operations

20020068968 NASA Ames Research Center, Moffett Field, CA USA

Evolutionary Optimization of a Quadrifilar Helical Antenna

Lohn, Jason D., NASA Ames Research Center, USA; Kraus, William F., QSS Group, Inc., USA; Linden, Derek S., Linden Innovation Research, USA; [2002]; 4p; In English; IEEE Antenna Propagation Society Conference, Unknown; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Automated antenna synthesis via evolutionary design has recently garnered much attention in the research literature. Evolutionary algorithms show promise because, among search algorithms, they are able to effectively search large, unknown design spaces. NASA's Mars Odyssey spacecraft is due to reach final Martian orbit insertion in January, 2002. Onboard the spacecraft is a quadrifilar helical antenna that provides telecommunications in the UHF band with landed assets, such as robotic rovers. Each helix is driven by the same signal which is phase-delayed in 90 deg increments. A small ground plane is provided at the base. It is designed to operate in the frequency band of 400-438 MHz. Based on encouraging previous results in automated

antenna design using evolutionary search, we wanted to see whether such techniques could improve upon Mars Odyssey antenna design. Specifically, a co-evolutionary genetic algorithm is applied to optimize the gain and size of the quadrifilar helical antenna. The optimization was performed in-situ in the presence of a neighboring spacecraft structure. On the spacecraft, a large aluminum fuel tank is adjacent to the antenna. Since this fuel tank can dramatically affect the antenna's performance, we leave it to the evolutionary process to see if it can exploit the fuel tank's properties advantageously. Optimizing in the presence of surrounding structures would be quite difficult for human antenna designers, and thus the actual antenna was designed for free space (with a small ground plane). In fact, when flying on the spacecraft, surrounding structures that are moveable (e.g., solar panels) may be moved during the mission in order to improve the antenna's performance.

Author

Helical Antennas; Antenna Design; Spacecraft Antennas; Genetic Algorithms; Design Optimization; Evolvable Hardware

20020069087 Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden

Field Trial with Measurements of Spatial and Temporal Correlations of Electromagnetic Fields in a Coastal Environment

Foersok med Maetningar av Elektromagnetiska Faelts Rums och Tidskorrelationer i en Kustnaera Miljoe

Lundqvist, B.; Dalberg, E.; Fristedt, T.; Sep. 2001; 20p; In Swedish

Report No.(s): PB2002-104974; FOI-R-0178-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An interesting problem when developing a system for magnetic anomaly detection (MAD) of foreign objects concerns the ability of a separate reference sensor to provide sufficient information on the electromagnetic background to make it possible to filter out the signal of the object itself from the noisy raw-data. In this report a study of the spatial and temporal correlations of the geomagnetic field for a typical coastal environment is presented. The surroundings of Djupviken in the southern archipelago of Stockholm were chosen for this purpose.

NTIS

Electromagnetic Fields; Coasts; Magnetic Anomalies

20020069151 National Defence Research Establishment, Div. of Sensor Technology, Linköping, Sweden

Optical Communication in Underwater Applications *Optisk Kommunikation i Undervattenstillämpningar*

Sjöqvist, L.; Kullander, F.; Lindgren, M.; Steinvall, O.; Mar. 2001; 50p; In Swedish

Report No.(s): PB2002-104966; FOI-R-0111-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An important capability of a future submarine system is the ability to communicate rapidly utilizing high data transfer rates. The communication should be secure enough to prevent the revealing of the position of the submarine. Unmanned underwater vehicles (UUV's) may become important since the UUV can be used for advanced surveillance. Information from the UUV's sensors needs to be transferred to the submarine and the control and command system. Free-space optical communication based on laser and fiber optics technology offers new exciting possibilities to transfer information in submarine applications. This report describes underwater applications using optical communication and laser technology. Different concepts for communication, focusing on retrocommunication, are discussed. Performance calculations covering important functions and technical possibilities are presented.

NTIS

Optical Communication; Underwater Communication; Fiber Optics; Free-Space Optical Communication

20020070454 Defence Evaluation Research Agency, Malvern, UK

Joint Air Command Laboratory

McQueen, S., Defence Evaluation Research Agency, UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 9-1 - 9-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper will describe the concepts behind the development of the JASPA prototype, within the Joint Air Command laboratory (JACL) at DERA Malvern.

Author

Military Operations; Prototypes; Air Defense; Mission Planning

20020070575 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

Design of 2.4GHz CMOS Direct Conversion LNA and Mixer Combination for Wireless Data-Link Transceiver

Zhao, D.; O'Connor, P.; 2000; 16p; In English

Report No.(s): DE2002-794023; BNL-69107; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Three LNA and mixer combinations in 0.6µm and 0.4µm standard CMOS processes for direct-conversion receiver of 2.4GHz ISM band short-range wireless data-link applications are described in this paper. Taking low power dissipation as first

consideration, these designs, employing differential common-source LNA and double balanced mixer architectures, achieve total conversion gain as high as 42.4dB, DSB noise figure as low as 9.5dB, output-referred I_{p3} as high as of 21.3dBm at about 4mA DC current consumption. This proves it is possible to apply standard CMOS process to implement receiver front-end with low power dissipation for this kind of application, but gain changeable LNA is needed to combat the dominant flicker noise of the mixer in order to achieve acceptable sensitivity and dynamic range at the same time.

NTIS

Data Links; Design; Direct Current; Dynamic Range

20020070598 National Defence Research Establishment, Avedelningen foer NBC Skydd, Umea, Sweden

Wave Propagation Analysis for Radio and Radar: A Pilot Study *Vagutbredningsanalys foer Radio och Radar. En Foerstudie*

Karlsson, E.; Asp, B.; Eriksson, G.; Rundgren, M.; Jun. 2001; In Swedish; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-104674; FOI-R-0099-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Methods to analyze the meteorological effects on wave propagation conditions for radio and radar are reviewed. This includes meteorological and wave propagation models, as well as techniques for measurement of environmental parameters needed as input to the models. Since the late 1980's the possibilities to calculate atmospheric effects on propagation loss and detection range have improved considerably, provided the refractivity conditions are known. A main reason for this is the introduction of propagation models based on parabolic equations (PE). With PE-models, which also can be used for communication frequencies, it is possible to consider horizontal variations in refractivity and terrain height variations. This is important when the environmental conditions are inhomogeneous along the propagation path, e.g. operations in littoral waters. The possibility to calculate the refractivity has also been improved by better point instruments for temperature and humidity, rocket sondes and IR-thermometers for measurements of the sea surface temperature. However, the possibility to determine horizontal variations of the refractivity and variation in time still are limited. Some solutions can be seen, e.g. the use of mesoscale meteorological models and remote sensing techniques using measurements from existing radio frequency transmitters.

NTIS

Wave Propagation; Radio Transmission; Meteorology; Atmospheric Temperature; Mesometeorology

33

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.

20020067715 NASA Ames Research Center, Moffett Field, CA USA

Influence of Scattering on Ballistic Nanotransistor Design

Anantram, M. P., NASA Ames Research Center, USA; Svizhenko, Alexei, NASA Ames Research Center, USA; Jun. 03, 2002; 2p; In English; Si Nanoelectronics Workshop, 9-10 Jun. 2002, Honolulu, HI, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Importance of this work: (1) This is the first work to model electron-phonon scattering within a quantum mechanical approach to nanotransistors. The simulations use the non equilibrium Green's function method. (2) A simple equation which captures the importance of scattering as a function of the spatial location from source to drain is presented. This equation helps interpret the numerical simulations. (3) We show that the resistance per unit length in the source side is much larger than in the drain side. Thus making scattering in the source side of the device much more important than scattering in the drain side. Numerical estimates of ballisticity for 10nm channel length devices in the presence of electron-phonon scattering are given. Based on these calculations, we propose that to achieve a larger on-current in nanotransistors, it is crucial to keep the highly doped source extension region extremely small, even if this is at the cost of making the highly doped drain extension region longer.

Author

Electron Scattering; Mathematical Models; Transistors; Nanotechnology; Design Analysis

20020067762 Naval Postgraduate School, Monterey, CA USA

Effects of Mutual Coupling in Small Dipole Array Antennas

Beng, Yeo C.; Mar. 2002; 67p; In English; Original contains color images

Report No.(s): AD-A403722; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the classical approach of antenna theories, mutual coupling between elements is usually ignored. However, depending on the application, errors due to mutual coupling can be significant. This thesis investigates the effects of mutual coupling between elements in small dipole arrays via software simulations that use the Methods of Moment, a numerical technique that accounts for mutual coupling, as opposed to the classical approach, which does not. The simulations show that the active impedance of any element in an array depends on both the self and mutual impedances and that the terminal current phases, hence directivity, of an array are affected by mutual coupling such that the array pattern deviates from that defined by classical theoretical approach. In an active element pattern approach, the mutual couplings in an array are accounted for through the active element, making this approach a viable one to study the radiation patterns of practical dipole arrays. The examination of a small array provides a useful environment in which to develop, optimize and evaluate the radiating elements, thus providing better understanding of the effects of mutual coupling in antenna arrays and facilitating the design of corresponding compensation techniques in practical arrays.

DTIC

Dipole Antennas; Antenna Radiation Patterns; Antenna Arrays; Optimization

20020067764 Minnesota Univ., Dept. of Electrical and Computer Engineering, Minneapolis, MN USA

New Integrated Optical Components for Broadband Communication Systems Final Report, 15 Mar. 1999-30 Sep. 2002

Gopinath, Anand; Osgood, Richard; Sep. 2002; 8p; In English; Prepared in collaboration with Columbia University, New York, NY

Report No.(s): AD-A403741; AFRL-SR-AR-TR-02-0220; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of this project was to design and fabricate polarization insensitive semiconductor optical amplifiers, design and fabricate planar optical isolators, investigate the possibility of their integration. Quantum well polarization insensitive semiconductor optical amplifiers in GaInAsP and AlInGaAs at 1300 nm, and the latter at 1550 nm were designed and tested, at Minnesota. Planar isolators in the Mach-Zehnder configuration were designed and tested at Columbia. The integration issues were investigated and a key component, the planar polarizer, was designed. Sputtered films for integration of the isolator were also investigated. For broadband system components, Minnesota examined the co-directional coupler, and arrived at a synthesis technique which does both amplitude and phase response. Columbia has examined the simulation of optical components and made considerable progress in practical simulation of mixed polarization devices. The report briefly outlines the results.

DTIC

Broadband; Gallium Phosphides; Semiconductors (Materials); Fabrication; Telecommunication; Indium Arsenides; Optoelectronic Devices

20020067795 Sheffield Univ., UK

Exciton Hybridisation in Organic-Inorganic Semiconductor Microcavities Final Report, 6 Jan. 2001-2 Jan 2002

Lidzey, David G.; Agranovich, V. M.; Feb. 01, 2002; 60p; In English; Original contains color images; --Original contains color plates: All DTIC reproductions will be in black and white. Prepared in cooperation with the Russian Inst. for Spectroscopy, Troitsk, Russia

Contract(s)/Grant(s): F61775-00-WE052

Report No.(s): AD-A404006; EOARD-SPC 00-4052; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Sheffield as follows: The contractor will investigate theoretically and experimentally the possibility of hybridizing organic and inorganic semiconductors in microcavities to produce a highly efficient light source that could be either a laser or a very efficient LED. The report describes fabrication of new types of microcavity containing organic semiconductors, including strongly-coupled microcavities based on two metallic mirrors. It further describes development of a theory of cavity polaritons in a disordered organic medium containing J-aggregates.

DTIC

Semiconductor Devices; Excitons; Order-Disorder Transformations; Organic Semiconductors; Light Sources

20020067798 Michigan Univ., Ann Arbor, MI USA

High-Speed All-Optical Switching in Semiconductor Microcavities via Coherent Control of Excitons *Final Report, 1 Nov. 1997-30 Apr. 2001*

Norris, Theodore B.; Apr. 2001; 30p; In English

Contract(s)/Grant(s): F49620-97-1-0533

Report No.(s): AD-A403976; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have carried out an extensive series of experiments on coherent control of semiconductor quantum microcavities. In these experiments, a phase-locked femtosecond optical pulse pair is used to excite the lower normal mode (cavity polariton), thereby controlling the reflection of a signal pulse tuned to the upper normal mode. Such a controlled reflection may be used as an all-optical switch with picosecond switching time. We have demonstrated that the effect of the microcavity is to provide a huge enhancement of the coherently controlled response compared to bare quantum wells. We have investigated in detail the microscopic physical processes responsible for the nonlinear optical response; the measured response fits well with theories based on the electron-hole Hamiltonian in the coherent-X(5) and 2nd-Born approximations. The physical limits to the coherent control are determined by excitation-induced dephasing; this limits the applicability of the switch in practical terms. We have discovered that the use of phase-locked excitation pulses is that one can generate novel intraband coherences in the quantum wells, arising from true quantum correlations between the cavity field and the carrier populations. The discovery of this effect was perhaps the first genuinely quantum optical effect observed in semiconductor microcavities.

DTIC

Cavities; Optical Switching; Semiconductors (Materials); Holes (Electron Deficiencies); Born Approximation

20020068023 FTL Systems, Inc., Rochester, MN USA

Very High Speed Integrated Circuits (VHISC) Hardware Description Language (VHDL) Interactive Validation Alchemy (VIVA). Technology and Software for Semiautomated, High Fidelity Validation of VHDL-Related Tools *Final Report, 9 Jul. 1996-31 May 2001*

Gallagher, Patrick; Newshutz, Robert; Seshadri, Sathyanarayanan; Thiagarajan, Senjeev; Willis, John; May 01, 2001; 68p; In English; Original contains color images

Contract(s)/Grant(s): F33615-96-C-1909; AF Proj. 6096

Report No.(s): AD-A404056; AFRL-IF-WP-TR-2001-1531; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of the VIVA program was to develop a tool to generate a suite of tests to validate the compliance of Very High Speed Integrated Circuits (VHSIC) Hardware Description Language (VHDL) tools to the standard definition. The test suite is semi-automated to enable maximum flexibility and coverage of the language definition, thus, precluding the introduction of language compliance errors in DoD systems designs that utilize VHDL. The approach includes lexical, syntactic semantic (analysis-time and elaboration-time), functional, and temporal tests. The test suite will include contextual situations and capacity testing in an interactive generation, test and analysis environment, for validating tools. The validation test generation tool development provides a lower cost, more reliable, and maintainable means for DoD/NIST to certify tools as VHDL-compliant. The approach also shows promise for helping automate other NIST certification tasks in the future. The tools can also be made available to VHDL vendors who want to test their newly developed tools for VHDL compliance so they can provide higher quality products to their customers.

DTIC

Computerized Simulation; Integrated Circuits; Architecture (Computers); Proving

20020068038 Analox Corp., Brook Park, OH USA

SEE Design Guide and Requirements for Electrical Deadfacing *Final Report*

Berki, Joe M., Analox Corp., USA; Sargent, Noel, Analox Corp., USA; July 2002; 74p; In English

Contract(s)/Grant(s): NASA Order H-34132-D

Report No.(s): NASA/CR-2002-211839; NAS 1.26:211839; M-1053; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this design guide is to present information for understanding and mitigating the potential hazards associated with de-mating and mating powered electrical connectors on space flight vehicles. The process of staging is a necessary function in the launching of space vehicles and in the deployment of satellites, and now in manned assembly of systems in space. During this electrical interconnection process, various environments may be encountered that warrant the restriction of the voltage and current present across the pins of an electrical connector prior to separation, mating, or in a static open non-mated configuration. This process is called deadfacing. These potentially hazardous environments encompass the obvious explosive fuel vapors and

human shock hazard, to multiple Electro-Magnetic Interference (EMI) phenomena related to the rapid rate of change in current as well as exposure to Radio Frequency (RF) fields.

Author

Electric Connectors; Design Analysis; Launch Vehicles; Electromagnetic Interference; Aerospace Systems; Systems Engineering

20020068070 Naval Academy, Annapolis, MD USA

Optical Limiting Within Capillary Waveguides

Wathen, Jeremiah J.; May 2002; 78p; In English; Original contains color images

Report No.(s): AD-A403767; 301-(2002); No Copyright; Avail: CASI; A05, Hardcopy

A study of the optical limiting characteristics of capillary waveguides containing highly nonlinear cores is reported. Nonlinear waveguides prove useful, both for the study of fundamental physical phenomena they display and for practical applications (such as optical limiting) they may fulfill. Work presented here strives to use nonlinear waveguides as optical limiting elements, incorporating the waveguides into geometries that may integrate into modern optical fiber systems. Multi-mode and single-mode nonlinear waveguides, with core diameters ranging from 3.2 to 200 micrometers, were filled with solutions of silicon naphthalocyanine (SiNc). SiNc displays large absorptive and refractive index nonlinearity. The transmission characteristics of these nonlinear waveguides were measured as a function of incident energy from two different pulsed, frequency-doubled Nd:YAG lasers (producing 7 ns and 5 ns pulses at 532 nm). For the multimode waveguides, nonlinear effects are observed at input energies as low as 1.0×10^{10} J and a transmission of 5% or less was observed for input energies as low as 1.0×10^7 J. For the single-mode waveguide, a limiting response was stimulated at input pulse energies less than 20 pJ. Multi-mode waveguide data were compared with a three-level sequential absorption model, which modeled the nonlinear behavior of SiNc.

DTIC

Optical Properties; Nonlinearity; Silicon Compounds; Optical Waveguides; Mathematical Models; Capillary Tubes

20020068087 Arkansas Univ., Fayetteville, AR USA

Direct Cooling of Propulsion drives for High Power Density and Low Volume Annual Report, 1 Apr. 2001-30 Jun. 2002

Balda, Juan C.; Barlow, Fred D.; Olejniczak, Kraig J.; Jul. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): N00014-01-1-0634

Report No.(s): AD-A404055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first Annual Report summarizes the activities performed on this grant from May 1, 2001, through June 30, 2002. One graduate student has been working on the overall direct cooling system design and packaging philosophy of our high-voltage, spray-cooled power module. Two other graduate students have investigated solution strategies for connecting IGBTs in series which are amenable to miniaturization and integration for our direct cooling packaging strategy. Finally, another graduate student has been working on novel SiC transistors for use in high-temperature power electronics packaging.

DTIC

Electronic Equipment; Propulsion; Cooling Systems; Systems Engineering

20020068103 NASA Marshall Space Flight Center, Huntsville, AL USA

Efficient Nondestructive Evaluation of Prototype Carbon Fiber Reinforced Structures

Russell, Samuel S., NASA Marshall Space Flight Center, USA; Walker, James, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 Assurance Technology Conference, 29-30 May 2002, Cleveland, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Thermography and shearography methods of inspection rely on optic based technologies and can reduce the time and cost required to inspect composite tanks or aerostructures. Usually areas identified as suspect in the initial inspection results are reexamined with ultrasonic methods. This combination of techniques results in a rapid and comprehensive inspection of composite structures. Development of useful defect standards will be discussed. Examples of application of this inspection philosophy to prototype, GSE, and flight hardware will be presented. Methods organizing the inspection and evaluating the results will be considered.

Author

Carbon Fibers; Prototypes; Shearography; Thermography; Composite Structures; Nondestructive Tests

20020068379 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia

Non-Linear and Robust Filtering: From the Kalman Filter to the Particle Filter

Ford, Jason; Apr. 2002; 53p; In English

Report No.(s): AD-A403921; DSTO-TR-1301; DODA-AR-012-300; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents a review of recent non-linear and robust filtering results for stochastic systems. We focus on stability and robustness issues that arise in the filtering of real systems. Issues such as numeric stability and the effect of non-linearity are also considered. The report begins by introducing the famous Kalman filtering problem before proceeding to introduce the extended Kalman filter and related stability results. Robust forms of the Kalman filter and extended Kalman filter are also considered and finally a particle filtering approach is presented. The report is intended to lead readers with a familiarity of the Kalman filtering problem through some of the more important recent (and not so recent) results on stability and robust filters in non-linear filtering problems.

DTIC

Stochastic Processes; Kalman Filters; Nonlinearity

20020068461 NASA Marshall Space Flight Center, Huntsville, AL USA

Poster Session Presentation: Hardware Evolution of Control Electronics

Gwaltney, David, NASA Marshall Space Flight Center, USA; Steincamp, Jim, NASA Marshall Space Flight Center, USA; Ferguson, M. Ian, Jet Propulsion Lab., California Inst. of Tech., USA; [2002]; 1p; In English; 2002NASA/DOD Conference on Evolvable Hardware, 15-18 Jul. 2002, Alexandria, VA, USA; Sponsored by NASA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This poster corresponding to a presentation explains a process for the evolution of both analog and digital circuits, which are examined experimentally for fitness.

CASI

Genetic Algorithms; Evolvable Hardware; Design Optimization

20020068707 NASA Ames Research Center, Moffett Field, CA USA

Modeling of Gate Bias Modulation in Carbon Nanotube Field-Effect-Transistor

Toshishige, Yamada, NASA Ames Research Center, USA; [2002]; 12p; In English

Contract(s)/Grant(s): DTT59-99-D-00437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The threshold voltages of a carbon-nanotube (CNT) field-effect transistor (FET) are studied. The CNT channel is so thin that there is no voltage drop perpendicular to the gate electrode plane, and this makes the device characteristics quite unique. The relation between the voltage and the electrochemical potentials, and the mass action law for electrons and holes are examined in the context of CNTs, and inversion and accumulation threshold voltages ($V_{\text{sub Ti}}$, and $V_{\text{sub Ta}}$) are derived. $V_{\text{sub Ti}}$ of the CNTFETs has a much stronger doping dependence than that of the metal-oxide- semiconductor FETs, while $V_{\text{sub Ta}}$ of both devices depends weakly on doping with the same functional form.

Author

Carbon Nanotubes; Field Effect Transistors; Bias; Modulation; Gates (Circuits)

20020068803 Alabama Agricultural and Mechanical Univ., Dept. of Electrical Engineering, Normal, AL USA

Directionally Sensitive Silicon Radiation Sensor (VCELL)

Cook, Koy B., Alabama Agricultural and Mechanical Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XI-1 - XI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Sensors are a mission critical element in many NASA programs and require some very unique properties such as small size, low power, high reliability, low weight. Low cost sensors offer the possibility of technology transfer to the public domain for commercial applications. One sensor application that is important to many NASA programs is the ability to point at a radiation source, such as the sun. Such sensors may be an integral part of the guidance and control systems in space platforms and in remote exploratory vehicles. Sun/solar pointing is also important for ground-based systems such as solar arrays. These systems are not required to be small and lightweight. However, if a sensor with a sun pointing capability was developed that is very small, rugged, lightweight and at the same time low cost, it certainly could be used in existing and perhaps many new ground based applications. The objective of the VCELL (Directionally Sensitive Silicon Radiation Sensor) research is to develop a new and very unique silicon based directionally sensitive radiation sensor which can be fabricated using conventional monolithic IC technologies and which will meet the above requirements. The proposed sensor is a novel silicon chip that is directionally sensitive to incident radiation, providing azimuth and elevation information on the incident radiation. The resulting sensor chip will be appropriate for integration into a silicon IC or useful in a hybrid structure to be interfaced with a standard IEEE 1451 bus interface IC to create an Intelligent Sensor. It is presently estimated that it will require about three man-years of effort to complete the VCELL research and development. This includes the optical, electrical, mechanical and silicon fabrication and testing as well as computer simulations and theoretical analysis and modeling including testing in simulated space environments. This report summarizes the

sensor research completed this summer as part of the Summer Faculty Fellowship Program. The primary effort was focused on activity necessary to fabricate prototype sensor. Fabrication activities included the design and development of a sensor fabrication process, the development of deposition and diffusion processes using the Thermco furnaces and solid sources, the development of preferential silicon etching processes, ordering necessary process supplies and chemicals, fabrication and tooling of necessary hardware items to support the required silicon process equipment in place in bldg. 4487 and bldg. 7804.

Derived from text

Remote Sensing; Radiation Sources; Indicating Instruments; Fabrication; Direction Finding

20020068893 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA

SOME Bus for Optical Data Distribution Final Report, 7 Feb.-30 Sep. 2000

Kulick, Jeffrey; May 14, 2002; 41p; In English

Contract(s)/Grant(s): DAAH01-97-D-R005

Report No.(s): AD-A403901; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the results of a project to fabricate an integrated electro-optical assembly consisting of a photo detector array, fiber-optic v-groove package, and a fiber ribbon containing integrated Bragg grating output couplers. Assembly of each of the subassemblies was completed. Final assembly and testing of the integrated device is pended subject to the availability of better out-coupling behavior.

DTIC

Fiber Optics; Microelectromechanical Systems; Bragg Gratings

20020069002 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Atomic Chain Electronics

Yamada, Toshishige, MRJ Technology Solutions, Inc., USA; [1998]; 8p; In English; Giga-scale Integration Technology of Session of Society of Engineering Science 1998, 27-29 Sep. 1998, WA, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Adatom chains, precise structures artificially created on an atomically regulated surface, are the smallest possible candidates for future nanoelectronics. Since all the devices are created by combining adatom chains precisely prepared with atomic precision, device characteristics are predictable, and free from deviations due to accidental structural defects. In this atomic dimension, however, an analogy to the current semiconductor devices may not work. For example, Si structures are not always semiconducting. Adatom states do not always localize at the substrate surface when adatoms form chemical bonds to the substrate atoms. Transport properties are often determined for the entire system of the chain and electrodes, and not for chains only. These fundamental issues are discussed, which will be useful for future device considerations.

Author

Atoms; Nanotechnology; Transport Properties; Molecular Chains; Molecular Electronics

20020069013 NASA Ames Research Center, Moffett Field, CA USA

On Substrate for Atomic Chain Electronics

Yamada, Toshishige, MRJ Technology Solutions, Inc., USA; Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Partridge, Harry, NASA Ames Research Center, USA; [1998]; 44p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A substrate for future atomic chain electronics, where adatoms are placed at designated positions and form atomically precise device components, is studied theoretically. The substrate has to serve as a two-dimensional template for adatom mounting with a reasonable confinement barrier and also provide electronic isolation, preventing unwanted coupling between independent adatom structures. However, the two requirements conflict. For excellent electronic isolation, we may seek adatom confinement via van der Waals interaction without chemical bonding to the substrate atoms, but the confinement turns out to be very weak and hence unsatisfactory. An alternative chemical bonding scheme with excellent structural strength is examined, but even fundamental adatom chain properties such as whether chains are semiconducting or metallic are strongly influenced by the nature of the chemical bonding, and electronic isolation is not always achieved. Conditions for obtaining semiconducting chains with well-localized surface-modes, leading to good isolation, are clarified and discussed.

Author

Adsorption; Atoms; Substrates; Nanostructures (Devices); Molecular Electronics

20020069107 National Inst. of Standards and Technology, Gaithersburg, MD USA

Surge Protection in Low-Voltage AC Power Circuits: An Anthology. Part 3. Recorded Surge Occurrences and Surveys

Jun. 2002; 116p; In English

Report No.(s): PB2002-107670; NISTIR-6714-3; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The present interest in this report is historical as the experiments and devices it described represent initial efforts in addressing the emerging problems associated with the introduction of semiconductors in the consumer market. This now declassified proprietary report was prepared to document experiments performed in the early sixties to assess the capability of devices available at that time for serving as surge-protective devices in residential circuits. The context was that the emerging electronic appliances were found vulnerable to transient overvoltages and therefore in need of some form of protection. The technology at that time offered the well-proven selenium rectifier (under the General Electric trade name 'Thyrector' among other similar offerings in the market), the well-known low-pass RC filter, and the emerging five-layer semiconductors. All these were then valid candidates but of course became completely supplanted ten years later when zinc-oxide based varistors were stumbled upon and quickly recognized as a promising technology. Interesting observations on the occurrence and propagation of surges in a low-voltage ac power system are also documented in this report, and these are still applicable today.

NTIS

Overvoltage; Surges; Buildings; Semiconductors (Materials); Low Pass Filters; AC Generators

20020069123 NASA Ames Research Center, Moffett Field, CA USA

Modeling of Gate Bias Modulation in Carbon Nanotube Field-Effect-Transistors

Yamada, Toshishige, NASA Ames Research Center, USA; [2002]; 1p; In English; American Vacuum Society Meeting, 4-8 Nov. 2002, Denver, CO, USA; Sponsored by American Vacuum Society, USA

Contract(s)/Grant(s): DTT59-99-D-00437; No Copyright; Avail: Issuing Activity; Abstract Only

The threshold voltages of a carbon nanotube (CNT) field-effect transistor (FET) are derived and compared with those of the metal oxide-semiconductor (MOS) FETs. The CNT channel is so thin that there is no voltage drop perpendicular to the gate electrode plane, which is the CNT diameter direction, and this makes the CNTFET characteristics quite different from those in MOSFETs. The relation between the voltage and the electrochemical potentials, and the mass action law for electrons and holes are examined in the context of CNTs, and it is shown that the familiar relations are still valid because of the macroscopic number of states available in the CNTs. This is in sharp contrast to the cases of quantum dots. Using these relations, we derive an inversion threshold voltage V_{th} and an accumulation threshold voltage V_{a} as a function of the Fermi level E_{F} in the channel, where E_{F} is a measure of channel doping. V_{th} of the CNTFETs has a much stronger dependence than that of MOSFETs, while V_{a} s of both CNTFETs and MOSFETs depend quite weakly on E_{F} with the same functional form. This means the transition from normally-off mode to normally-on mode is much sharper in CNTFETs as the doping increases, and this property has to be taken into account in circuit design.

Author

Bias; Carbon Nanotubes; Electric Potential; Field Effect Transistors; Modulation; Threshold Voltage

20020069129 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Substrate Effects on Electronic Properties of Atomic Chains

Yamada, Toshishige, MRJ Technology Solutions, Inc., USA; [1998]; 4p; In English; 1998 Foresight Conference, 12-15 Nov. 1998, Santa Clara, CA, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

When the device size is reduced down to 0.07 micrometers, the number of dopant atoms in the channel will no longer be macroscopic, typically less than a hundred. A spatial distribution of these dopant atoms will fluctuate statistically from device to device even in identically designed devices, and this places a serious limitation for integration. It is, however, impractical to control dopant positions within atomic dimension. One fundamental solution to this problem is to create electronics with atomically precise, but preferably simple structures. Atomic chains, precise structures of adatoms created on an atomically regulated surface, are candidates for constituent components in future electronics. All the adatoms will be placed at designated positions on the substrate, and all the device structures will be precise, free from any deviations. It was predicted using the tight-binding calculation with universal parameters that silicon chains were metallic and magnesium chains were semiconducting regardless of the lattice spacing, and a possible doping method was also proposed. In these treatments, the substrate was assumed to serve as a non-interacting template holding the adatoms without a formation of chemical bonding with substrate atoms. However, this scheme may not be easy to implement experimentally. Adatoms will have to be fixed with a van der Waals force on the substrate, but the force is generally weak and an extremely low temperature environment has to be prepared to suppress

their unwanted thermal displacement. It may be logical to seek a scheme to allow the adatoms to form chemical bonding with the substrate atoms and secure their positions. The substrate effects are studied in detail.

Derived from text

Microelectronics; Silicon; Substrates; Atoms; Chemical Bonds

20020069142 NASA Marshall Space Flight Center, Huntsville, AL USA

Options and Risk for Qualification of Electric Propulsion System

Bailey, Michelle, NASA Marshall Space Flight Center, USA; Daniel, Charles, Daniel (Charles), USA; [2002]; 1p; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; No Copyright; Avail: Issuing Activity; Abstract Only

Electric propulsion vehicle systems envelop a wide range of propulsion alternatives including solar and nuclear, which present unique circumstances for qualification. This paper will address the alternatives for qualification of electric propulsion spacecraft systems. The approach taken will be to address the considerations for qualification at the various levels of systems definition. Additionally, for each level of qualification the system level risk implications will be developed. Also, the paper will explore the implications of analysis verses test for various levels of systems definition, while retaining the objectives of a verification program. The limitations of terrestrial testing will be explored along with the risk and implications of orbital demonstration testing. The paper will seek to develop a template for structuring of a verification program based on cost, risk and value return. A successful verification program should establish controls and define objectives of the verification compliance program. Finally the paper will seek to address the political and programmatic factors, which may impact options for system verification.

Author

Electric Propulsion; Technology Assessment; Qualifications; Proving

20020070591 Department of Energy, Washington, DC USA

Self- and Zinc Diffusion in Gallium Antimonide

Piers, S.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM Report No.(s): DE2002-795370; No Copyright; Avail: National Technical Information Service (NTIS)

The technological age has in large part been driven by the applications of semiconductors, and most notably by silicon. Our lives have been thoroughly changed by devices using the broad range of semiconductor technology developed over the past forty years. Much of the technological development has its foundation in research carried out on the different semiconductors whose properties can be exploited to make transistors, lasers, and many other devices. While the technological focus has largely been on silicon, many other semiconductor systems have applications in industry and offer formidable academic challenges. Diffusion studies belong to the most basic studies in semiconductors, important from both an application as well as research standpoint. Diffusion processes govern the junctions formed for device applications. As the device dimensions are decreased and the dopant concentrations increased, keeping pace with Moore's Law, a deeper understanding of diffusion is necessary to establish and maintain the sharp dopant profiles engineered for optimal device performance. From an academic viewpoint, diffusion in semiconductors allows for the study of point defects. Very few techniques exist which allow for the extraction of as much information of their properties. This study focuses on diffusion in the semiconductor gallium antimonide (GaSb). As will become clear, this compound semiconductor proves to be a powerful one for investigating both self- and foreign atom diffusion. While the results have direct applications for work on GaSb devices, the results should also be taken in the broader context of III-V semiconductors. Results here can be compared and contrasted to results in systems such as GaAs and even GaN, indicating trends within this common group of semiconductors. The results also have direct importance for ternary and quaternary semiconductor systems used in devices such as high speed InP/GaAsSb/InP double heterojunction bipolar transistors (DHBT) (Dvorak, (2001)). Many of the findings which will be reported here were previously published in three journal articles. Hartmut Bracht was the lead author on two articles on self-diffusion studies in GaSb (Bracht, (2001), (2000)), while this report's author was the lead author on Zn diffusion results (Nicols, (2001)). Much of the information contained herein can be found in those articles, but a more detailed treatment is presented here.

NTIS

Diffusion; Gallium Antimonides; Zinc

20020070594 Institute of Electron Technology, Warsaw, Poland

Transparent ZnO-Based OHMIC Contact to p-GaN

Kaminska, E.; Piotrowska, A.; Golaszewska, K.; Guziewicz, M.; Kruszka, R.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795374; No Copyright; Avail: National Technical Information Service (NTIS)

Highly conductive ZnO films were fabricated on p-GaN in a two-step process. First, zinc was thermally evaporated on p-GaN. Next, zinc film was oxidized in oxygen flow. to increase the conductivity of ZnO, nitrogen was introduced into zinc during its deposition. The above procedure proved successful in fabricating ZnO of the resistivity of (approx) $1 \times 10(\exp -3)$ (Omega)cm and resulted in ohmic contacts of resistivity (approx) $1 \times 10(\exp -2)$ (Omega)sq cm to low-doped p-GaN, and light transmittance of (approx)75% in the wavelength range of 400-700 nm.

NTIS

Zinc Oxides; Gallium Nitrides; Conductors; Doped Crystals

20020070595 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA

NIST 30/60 MHz Tuned Radiometer for Noise Temperature Measurements

Grosvenor, C. A.; Billinger, R. L.; May 2002; 40p; In English

Report No.(s): PB2002-103647; NIST/TN-1525; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NIST Noise project has completed reconstruction of its 30/60 MHz tuned, coaxial (Type N) radiometer system. This system is used at low frequencies, where isolators are impractical to incorporate. Without isolators, the ambient and cryogenic standards are tuned to the impedance of the device under test to minimize mismatches. Although this system had existed prior to publication of this technical note, enough modifications and improvements have been made to warrant a new report. This note will briefly review the original system, and discuss the theory as well as the design, testing, and capabilities of the present system. More detailed uncertainty analyses as well as details of system troubleshooting are also included.

NTIS

Noise Temperature; Radiometers; Temperature Measurement

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FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.

20020067662 NASA Glenn Research Center, Cleveland, OH USA

Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows

LaGraff, John E., Editor, NASA Glenn Research Center, USA; Ashpis, David E., Editor, NASA Glenn Research Center, USA; April 2002; 86p; In English; Minnowbrook III, 20-23 Aug. 2000, Blue Mountain Lake, NY, USA; Also announced as 20020067663 through 20020067692; The conference proceeding is available in hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation

Contract(s)/Grant(s): RTOP 706-31-23

Report No.(s): NASA/CP-2001-210888; E-12764; NAS 1.55:210888; NONP-NASA-CD-2002101352; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

This volume and its accompanying CD-ROM contain materials presented at the Minnowbrook III-2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows held at the Syracuse University Minnowbrook Conference Center, Blue Mountain Lake, New York, August 20-23, 2000. Workshop organizers were John E. LaGraff (Syracuse University), Terry V Jones (Oxford University), and J. Paul Gostelow (University of Leicester). The workshop followed the theme, venue, and informal format of two earlier workshops: Minnowbrook I (1993) and Minnowbrook II (1997). The workshop was focused on physical understanding the late stage (final breakdown) boundary layer transition, separation, and effects of unsteady wakes with the specific goal of contributing to engineering application of improving design codes for turbomachinery. The workshop participants included academic researchers from the USA and abroad, and representatives from the gas-turbine industry and government laboratories. The physical mechanisms discussed included turbulence disturbance environment in turbomachinery, flow instabilities, bypass and natural transition, turbulent spots and calmed regions, wake interactions with attached and separated boundary layers, turbulence and transition modeling and CFD, and DNS. This volume contains abstracts and copies of the viewgraphs presented, organized according to the workshop sessions. The viewgraphs are included on the

CD-ROM only. The workshop summary and the plenary-discussion transcripts clearly highlight the need for continued vigorous research in the technologically important area of transition, separated and unsteady flows in turbomachines.

Author

Conferences; Computational Fluid Dynamics; Boundary Layer Transition; Computer Aided Design; Computer Programs; Turbulence Models; Unsteady Flow

20020067665 Technische Univ., Jet Propulsion Lab., Berlin, Germany

Free Stream Unsteadiness and Turbulence: What is the Difference?

Hourmouziadis, J., Technische Univ., Germany; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 92-98; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Boundary layer transition on the blading of turbomachinery is dominated by three phenomena: 1. Periodic unsteadiness. 2. High levels of free stream turbulence. 3. Very often separated shear layers. The latter have been well known for several decades now and are usually accounted for empirically in design systems. Periodic unsteadiness has received increasing attention since the presentation of the investigations in the General Electric low speed compressor at the ASME Gas Turbine Conference 1995. Working with unsteady boundary layers gives rise to a variety of questions concerning the physical understanding of the transition process. It even leads to doubts about traditional interpretations in steady flow. The following problems will be offered for discussion. 1. Using an order of magnitude analytical approach, an amplitude-weighted Strouhal-no. is identified as a significant similarity parameter. Using this parameter and the Reynolds-no. a classification of unsteady flows is performed. 2. Blade passing in turbomachinery and classical shear flows are classified in this framework. 3. With the amplitude-weighted Strouhal-no. turbulence is resolved into a continuous spectrum of discrete frequency intervals. This model is used to classify the response of turbomachinery boundary layers using typical spectra from low speed and high speed full size experiments.

Author

Numerical Analysis; Turbulence; Unsteady Flow; Boundary Layer Transition; Shear Flow

20020067666 Tasmania Univ., School of Engineering, Hobart, Australia

Natural Versus Bypass Transition on Axial Compressor Blades: A Need for Reassessment?

Walker, G. J., Tasmania Univ., Australia; Hughes, J. D., Tasmania Univ., Australia; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 99-123; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The transitional flow behavior on the outlet stator blades of a 1.5-stage axial compressor has been studied extensively using an array of surface hot film gauges covering both suction and pressure surfaces. Various techniques have been developed to identify flow regimes and individual events from fluctuations in quasi wall shear stress obtained from the surface gauges. Earlier work by Solomon and Walker was concerned with the evaluation of turbulent intermittency and the relaxation of flow following the passage of turbulent spots. The most recent studies by the present authors have involved the use of wavelet analysis to identify events characteristic of laminar instability waves. Pitchwise average values of random inflow disturbance (free stream turbulence) experienced by the stator blades ranged from 2 to 3%, and ensemble average values were locally as high as 10% in passing rotor wakes. Despite these elevated free stream turbulence levels there was an almost universal evidence of instability wave amplification prior to turbulent breakdown in decelerating flow regions on the compressor blade. Although the two-dimensional wave amplification stage was apparently bypassed, there was no evidence for direct production of turbulent spots within the boundary layer supposed within the turbomachinery community to be characteristic of bypass transition. Unstable laminar flow regions up to 20% chord in length were observed on the compressor blade in these investigations, both in the path of turbulent strips induced by passing rotor blade wakes and in regions between these wake-induced transition paths in the time-chordwise position plane. The signatures of individual instability wave events and their subsequent breakdown observed by the surface film gauges closely resembled those of wave packets in basic experiments on artificially generated spots arising from weak localised initial disturbances. The wave packet events showed evidence of amplification prior to breakdown. This observation provides further justification for use of the modified eN method of predicting turbulent breakdown in natural transition, which was successfully applied by Solomon et al. (1999) in a quasi-steady manner to predict temporal fluctuations in transition onset on the compressor stator blades. Interestingly, the values of exponent eN typically required for the compressor blade boundary layers were roughly comparable with those for the non-linear amplification stage in natural transition with a very low level of free stream turbulence. Wave activity both occurred in and originated from the calmed region following the passage of a wake-induced

turbulent strip on the compressor blade. This activity could have arisen either from the attendant wave packets that occur in adverse pressure gradients (as with artificially generated turbulent spots) or from the turbulent perturbations within the wake-induced turbulent strip itself. The more stable flow in the ensuing "calmed region" clearly did not guarantee the total absence of instability wave activity. The length of transitional flow along an individual disturbance path was also observed to reach 20% of chord on the compressor stator. Thus the total length of blade surface over which the flow was governed by natural transition phenomena (either directly through wave packet amplification or indirectly through determining the dominant Tollmien-Schlichting wave frequency which governs the turbulent spot inception rate) was as much as 40% chord. The presentation concludes by inviting discussion on the following points: 1. the need for a more precise definition of the term "bypass" in relation to transition on turbomachine blades, and the need for greater consistency in definitions of bypass transition used by researchers in the turbomachinery and transition physics communities; 2. the desirability of complementary transition studies in accelerating flow, where bypass phenomena should be relatively more important, and the efficacy of zero pressure gradient ("flat plate") studies which lie on the boundary of two significantly different regimes; and 3. remaining challenges for predicting turbulent breakdown on turbomachine blades.

Author

Transition Flow; Flow Characteristics; Walls; Wakes; Nonlinearity; Boundary Layer Stability

20020067667 Cambridge Univ., Whittle Lab., Cambridge, UK

Separation Bubble Interactions With Turbulent Spots and Wakes in the Turbomachinery Environment at Reynolds Number of Around 130,000

Howell, R. J., Cambridge Univ., UK; Hodson, H. P., Cambridge Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 124-141; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the details of the interactions of individual turbulent spots, their calmed regions and separation bubbles. Many hot wire and film measurements have shown that wakes cause turbulent spots to form in the boundary layer at the approximate position where flow separation would normally occur with steady inflow. Artificially generated individual turbulent spots were created just before flow separation on a flat plate with imposed turbine pressure distribution. This caused the (normally) separated boundary layer to reattach to the blade surface. A large number of detailed unsteady measurements were taken to show how the velocity profiles of a separation bubble were affected by the passage of turbulent spots and their calmed regions. Other experiments also included the effects of wakes. These measurements showed that initially, the inner part of the separation bubble was reattached by the presence of a turbulent spot, while the outer half of the velocity profile remained unaffected. Only when 50% of the length of the spot had reached the separation location, did any changes occur in the outer half of the separation bubble. The spot seems to act like a wedge travelling under the separation bubble at first and as the rest of the spot reaches the separation location, the higher regions of what was the separation bubble are then affected. During this process there is a reduction in shape factor from 3.4 to 1.6. As the calmed region passed by, the flow gradually relaxed back to a separated boundary layer. At the trailing edge of the flat plate, the effects of the calmed region were present for up to three times the duration of the turbulent part of the spot.

Author

Bubbles; Interactions; Turbulent Wakes; Turbomachinery; Reynolds Number; Boundary Layer Separation

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Visualization of Transitional Heat Flux in the Presence of Freestream Turbulence and Pressure Gradient

Jones, T. V., Oxford Univ., UK; Anthony, R. J., Oxford Univ., UK; LaGraff, J. E., Syracuse Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 142-162; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Optimum design of gas turbine blades depends on accurate prediction of boundary layer transition. The purpose of this research is to obtain more information on the generation, propagation, and coalescence of turbulent spots in a transitional boundary layer, including the effects of freestream turbulence, favourable and adverse pressure gradients, and spanwise acceleration. Turbulent spot heat flux images are obtained using high-density thin film heat transfer gauge arrays developed especially for this study. The non-intrusive sensor arrays allow high frequency (up to 200 kHz), high spatial resolution (0.2 mm) surface heat flux measurements to be made. Figure 1 illustrates their use on a flat plate wind tunnel model. Experiments are run in a subsonic wind

tunnel at Oxford over a range of Reynolds number and Mach number (0.1-0.4). Surface heat flux is driven by a temperature difference between the model and freestream airflow. Experimental results clearly show increasing freestream turbulence intensity Tu significantly increases turbulent spot generation rate. At higher levels of freestream turbulence, most of the heat transfer fluctuations are caused by freestream eddies entering deep into the boundary layer. Favorable pressure gradient lengthens the transition region, while adverse pressure gradient hastens instability and can easily lead to abrupt separated flow transition. There also appear to be fundamental differences between the dynamics of bypass 'spots' or streaks, and natural spots. For example, individual bypass 'spots' do not appear to grow as much as natural spots in accelerating flow. High frequency measurements with spanwise detail enable direct measurement of turbulent spot generation rate, spot size, and spot/streak shapes. The imaging capability presented may allow us to "see" a few more pieces of the transition "puzzle" that we have not been able to see clearly before. New data such as this may lead to a better understanding of boundary layer transition in complex flows.

Author

Heat Flux; Turbulent Heat Transfer; Pressure Gradients; Gas Turbine Engines; Flow Visualization

20020067669 Liverpool Univ., Dept. of Mechanical Engineering, UK

The Initiation and Development of Turbulent Spots

Johnson, Mark W., Liverpool Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 163-176; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The turbulent spot can be considered as the 'building block' of a transitional boundary layer flow. The appearance of the first turbulent spots defines the start of transition location and the rate at which the spots grow and merge determines the transition length. A better understanding of how spots are initiated and develop can therefore lead to more accurate prediction in the transition process. Work over the past few years, has shown that freestream turbulence leads to the development of low frequency fluctuations within the laminar boundary layer, which grow in amplitude as the boundary layer develops. For bypass transition this growth is approximately linear with streamwise distance, but in the case of natural transition the growth is supplemented through the exponential growth in Tollmien-Schlichting frequencies once the stability limit is reached. The laminar fluctuations eventually reach a critical amplitude which is sufficient to initiate turbulent spots. The author has previously developed a simple model which suggests that a turbulent spot is initiated each time the near wall local velocity drops below 50% of its mean value and that this criterion leads to a transient separation of the flow due to the onset of a local instability. In the present work, new statistical data derived from hot wire signals measured in the near wall region of pre-transitional boundary layers is shown to support this model. The rate at which threshold events are observed in the experiment also correlates with the observed spot production rate. The structure of turbulent spots has been studied numerically using a linear perturbation procedure. The results show that, once a transient separation point is formed, it moves downstream below the trailing edge of the developing turbulent spot and hence moves with the spot trailing edge velocity of approximately 50% of that of the freestream. The fluid motion within the spot can be usefully interpreted from the point of view of an observer travelling with this velocity. In a laminar flow, this observer will see two streams of fluid. The first stream, consists of fluid close to the wall (u/U less than 0.5) which will approach the observer from downstream. The second stream is formed from fluid further from the wall which will approach him from upstream. Once the spot is formed the first stream is lifted from the surface around the hairpin vortex, which exists at the tail of the spot, and is accelerated forwards into the spot to move downstream away from the observer. The second stream drops towards the surface, to fill the space vacated by the first stream, before bifurcating behind the spot. The lower bifurcation branch approaches the wall behind the separation point such that the resulting increase in skin friction decelerates the flow so that it moves, relative to the observer, back upstream to form the calmed region. The upper bifurcation branch moves over the top of the hairpin vortex to mix out with the first stream within the spot. A number of flow visualisation movies created from the calculation results have been used to interpret the details of the flow structure. Numerical information on the extent and shape of the spot and calmed region have also been used to create correlation equations for spot propagation parameters as functions of streamwise pressure gradient and boundary layer Reynolds number.

Author

Turbulence; Boundary Layer Flow; Numerical Analysis; Horseshoe Vortices; Pressure Gradients

20020067670 Cambridge Univ., Whittle Lab., Cambridge, UK

On the Dynamics of the Calmed Region Behind a Turbulent Spot

Ramesh, O. N., Cambridge Univ., UK; Hodson, H. P., Cambridge Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 177-190; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the

papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The calmed region behind a spot is the focus of this study. Here, a simple two-dimensional analysis is done in order to study the dynamics of the calmed region. By considering the near wall dynamics of the calmed region in an Eulerian sense, by neglecting advection and turbulent stress terms in the streamwise momentum equation, an expression for the time variation of the skin friction is obtained. This expression bears out the intuitive expectation that the skin friction at a location decays exponentially to the laminar value after the passage of a turbulent spot. This seems to be the case irrespective of the mean pressure gradient as long as the flow remains attached. Furthermore, it also suggests a way of plotting the skin friction variation with time for different pressure gradients so that all of them could be collapsed onto a single curve. For calmed regions in a constant pressure flow, the variation of integral parameters and the duration of the calmed zone can be estimated by solving the unsteady momentum integral equation. The expression obtained for the duration is roughly in accord with the form suggested by a crude order of magnitude analysis of the momentum equation. More importantly, it is shown that the benign aspects of the calmed region such as stability to infinitesimal disturbances could be explained heuristically. By considering the equation for near-wall dynamics for a constant pressure flow, it could be seen that the vorticity profile in the calmed region is qualitatively similar to that of a steady favourable pressure gradient flow and hence stable; the role of pressure gradient in the steady flow being similar to that of the unsteady term in the calmed zone. If there is a mean pressure gradient in the flow, it will add to the unsteady term thereby modifying the vorticity profile and hence the stability characteristics of the calmed zone.

Author

Estimating; Flow Characteristics; Integral Equations; Pressure Effects; Steady Flow

20020067671 Oxford Univ., Dept. of Engineering Science, Oxford, UK

The Visualisation and Measurement of the Onset, Turbulent Spot Production Rate, Intermittency and Transfer During Wake-Induced Transition Using Thermochromic Liquid Crystals

Kittichaikarn, C., Oxford Univ., UK; Ireland, P. T., Oxford Univ., UK; Zhong, S., Manchester Univ., UK; Hodson, H. P., Cambridge Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 191-196; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A detailed experimental investigation was carried out to study the process of boundary layer transition induced by a bar generated wake travelling over a laminar boundary layer on a flat plate. Wake-induced transition is believed to take place via discrete turbulent spots and an encapsulated cholesteric liquid crystals coating has been employed on a heated flat plate to reveal detailed information over the full surface. The information includes the thermal characteristics, the spot onset locations in time and space and the spot formation rate. The results are also compared to intermittency plots and time-distance diagrams obtained by using surface-mounted thin film gauges. The data are also compared to well established correlations and other published data from the literature for existing wake-induced transition models. It is found that the onset is distributed beneath the trajectory of the wake.

Author

Experimentation; Flow Visualization; Flow Measurement; Heat Transfer; Turbulence

20020067672 NASA Glenn Research Center, Cleveland, OH USA

The NASA Low-Pressure Turbine Flow Physics Program: A Review

Ashpis, David E., NASA Glenn Research Center, USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 197-221; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An overview of the NASA Glenn Low-Pressure Turbine (LPT) Flow Physics Program will be presented. The flow in the LPT is unique for the gas turbine. It is characterized by low Reynolds number and high freestream turbulence intensity and is dominated by interplay of three basic mechanisms: transition, separation and wake interaction. The flow of most interest is on the suction surface, where large losses are generated due to separation. The LPT is a large, multistage, heavy, jet engine component that suffers efficiency degradation between takeoff and cruise conditions due to decrease in Reynolds number with altitude. The performance penalty is around 2 points for large commercial bypass engines and as much as 7 points for small, high cruise altitude, military engines. The gas-turbine industry is very interested in improving the performance of the LPT and in reducing its weight, part count and cost. Many improvements can be accomplished by improved airfoil design, mainly by increasing the airfoil loading that can yield reduction of airfoils and improved performance. In addition, there is a strong interest in reducing the design cycle time and

cost. Key enablers of the needed improvements are computational tools that can accurately predict LPT flows. Current CFD tools in use cannot yet satisfactorily predict the unsteady, transitional and separated flow in the LPT. The main reasons are inadequate transition & turbulence models and incomplete understanding of the LPT flow physics. NASA Glenn has established its LPT program to answer these needs. The main goal of the program is to develop and assess models for unsteady CFD of LPT flows. An approach that consists of complementing and augmenting experimental and computational work elements has been adopted. The work is performed in-house and by several academic institutions, in cooperation and interaction with industry. The program was reviewed at the Minnowbrook II meeting in 1997. This review will summarize the progress that was made since and will introduce newly started projects. The LPT program is focused on three areas: acquisition of experimental and numerical databases and on modeling and computation. Priority was initially given to experiments. There are three classes of experiments: simulated LPT passages, linear cascade, both with and without wakes, and low-speed rotating rig. They are being conducted as follows: At NASA GRC on a flat surface with blade pressure distribution, at the US Naval Academy on a curved surface. The addition of wakes is studied at the University of Minnesota in a curved passage with a retractable wake generator, and at Texas A&M University in a linear cascade with continuously running wake generator. The pressure distribution of the Pratt & Whitney blade 'Pak B' is used in all these experiments. Experiments have been performed also in the GEAE Low-Speed Rotating Turbine (LSRT) rig with GE-designed airfoils. Work on numerically generated database is in progress at the University of Kentucky, using the DNS/LES code LESTool developed there. Turbulence/transition model assessment and development is performed also at the University of Kentucky, where a new intermittency transport model was developed and many experimental test cases have been numerically computed. Assessments of models using simulations of multistage LPT experiments were performed at Virginia Commonwealth University using the Corsair code. Work on suction surface separation delay, using passive and active flow-control, has also been initiated. Following the overview, Principal Investigators attending the workshop will present in detail several of the projects supported by NASA.

Author

Low Pressure; Turbines; Fluid Dynamics; Low Reynolds Number; Computational Fluid Dynamics

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Predictions of Transitional Flows in a Low Pressure Turbine Using an Intermittency Transport Equation

Suzen, Y. B., Kentucky Univ., USA; Xiong, G., Kentucky Univ., USA; Huang, P. G., Kentucky Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 222-245; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new transport equation for the intermittency factor is presented to predict the transitional flows in low-pressure turbine applications. The intermittent behavior of the transitional flows is taken into account and incorporated into the computations by modifying the eddy-viscosity, $\mu_{\text{sub } t}$, with the intermittency factor, γ . Turbulent quantities are predicted by using Menter's two-equation turbulence model (SST) and the intermittency factor is obtained from the solution of a recently developed transport equation model. The new transport equation model not only can reproduce the experimentally observed streamwise variation of the intermittency in the transition zone, but it also provides a realistic cross-stream variation of the intermittency profile. The new model is applied to predictions of a modern low-pressure turbine experiment and detailed comparisons of the computational results with the experimental data are presented. The new model has been shown to be capable of predicting the low-pressure turbine flow transition under a variety of Reynolds number and freestream turbulence conditions.

Author

Mathematical Models; Turbulence Models; Transition Flow

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ERCOFTAC Transition Modeling Special Interest Group Thematic Network Transpreturb: Transition Prediction Methods for Turbomachinery and Other Aerodynamic Flows

Dick, Erik, Ghent Univ., Belgium; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 246-254; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The interest group and thematic network have 25 participating research groups from universities, research institutes and industry. There are 5 subgroups: "Intermittency and Simple Model Approaches" studies intermittency concept based methods and integral methods; "Eddy Viscosity Models" studies two-equation approaches, including non-linear extensions like NLEVM and EARSIM; "Reynolds Stress Transport Models"; "Transition Simulation" mainly uses LES as analysis tool and as means to create

numerical data bases; "Experimental Data", aims at near-reality test cases, both steady and unsteady. The thematic network receives EC funding for the period September 1998 to August 2001. The thematic network has as objective to come to models for bypass transition which can be used in everyday industrial practice. The industrial partners insist on methods with sufficient generality but without much complexity. This implies that integral methods are considered as not general enough and that approaches based on conditionally averaged equations and approaches using RSM are seen as too complex. The technique preferred by the industrial partners is two-equation turbulence models (k-epsilon and k-omega types, two-layer types), with or without non-linear extensions, complemented with an intermittency transport equation. As a consequence of this industrial preference, in practice there is no strict distinction between the activities of the subgroups 1,2 and 3. Subgroups 2 and 3 have formally merged and some partners are active in different subgroups. For the development of models, it was agreed to use a sequence of test cases with increasing complexity: T3L, semi-circular leading edge (Rolls-Royce data), to be used by all partners working on modelling, especially T3L1 (0.2 % fst) and T3L3 (3% fst); further, to be used by as many partners as appropriate: T3H, flat plate with heat transfer, 5% fst (Kiev data); T3K, linear turbine cascade (Ercotac Turbomachinery Sig data): T3K (Durham), T3K+(Lyon); T106, unsteady turbine cascade (Cambridge data); IGV-rotor-stator (Tasmania data). Additionally, Subgroup 1 uses VKI linear turbine cascade data. Subgroups 2 and 3 use DNS data for laminar separation bubble induced transition, DNS data for oscillating flat plate boundary layer, DNS data for wake passing transition, all three data from Stanford. Subgroup 4 works at LES simulations of the cases T3L and T106 with and without wake passage (Surrey). Fundamental DNS simulations have been done (Stockholm). Subgroup 5 works at experiments on a steam turbine IGV/rotor (Genua), a steam turbine rotor/stator (Czestochowa), a multi-stage compressor (Cranfield). Experimental work on T3L with and without wake passage (Thessaloniki and Brussels) is finished at this moment.

Derived from text

Boundary Layers; Heat Transfer; K-Epsilon Turbulence Model; Mathematical Models; Turbomachinery; Turbulence Models

2002006765 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Modelling of By-Pass Transition by Means of a Turbulence Weighting Factor

Steelant, J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Dick, E., Ghent Univ., Belgium; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 255-271; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In contrast to natural transition which emanates from the breakdown of amplified disturbances within the boundary layer, by-pass transition is caused by the free-stream turbulence affecting the pre-transitional (pseudo-laminar) layer directly by diffusion and indirectly by pressure fluctuations. If the free-stream turbulence is high enough, i.e. $Tu > 1\%$, the transition happens far further upstream than what would be expected for natural transition. Also the transition length is shorter and is directly related to the turbulence level. The diffusion of turbulent eddies into the boundary layer prior to the transition onset has an intermittent character and is first localized in the outer part of the laminar boundary layer. Intermittent behaviour is also seen during the transition where the flow in the boundary layer is characterized by distinct turbulent and laminar phases alternating in function of time. The intermittent behaviour during transition has been quantified by the intermittency factor g . This factor is the relative fraction of time during which the flow is turbulent at a certain position. It evolves from 0% at the transition point up to 100% at the end of transition. The same relative fraction of time can be taken to quantify the intermittent behaviour of the diffusing turbulent eddies in the pseudo-laminar boundary layer. This parameter, named here as freestream factor w , is 0% near the wall and tends to 100% in the freestream.

Derived from text

Bypasses; Laminar Boundary Layer; Free Flow; Turbulent Boundary Layer; Pressure Gradients

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Toward Direct Numerical Simulations of Turbine Flows

Herbert, Thorwald, Ohio State Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 272-286; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In spite of partial success, we have halted our attempt to analyze transition in turbine boundary layers by studying the stability of an initially laminar flow because the rise of turbulence seems to be associated with unacceptable changes of the core flow. Instead, we have adopted the conclusion of the last meeting and worked toward the direct, simulation of realistic flows in turbines to obtain insight into the structure of turbulence and heat transfer. Estimates show that, in spite of a patchy turbulent core flow,

the buffeted boundary layer may go through transition, but the time of travel through the passage may be insufficient, the change in local conditions too rapid, and periodic unsteadiness too severe to establish the mature "textbook turbulence" underlying common turbulence models. The large scale of the computational task requires distributing the work load over a group of computers. Different basic equations (e.g. for fluid flow and heat conduction) may need to be solved in adjacent domains. Moreover, the results of the unsteady computation cannot be saved and analysis of the data must be performed simultaneously with the computation. To address these and other requirements, we have designed and developed major components of DICE - a Distributed Interactive Computing Environment. On the highest level, DICE consists of a framework void of any physical problems or numerics. This framework executes any number of addressable modules on prescribed or internally chosen hosts on a heterogeneous computer network, typically a network of workstations under UNIX, Linux, or Windows NT. These modules can be computational solvers for a given set of equations in one block of the physical domain, modules for visualization or plotting, graphical user interfaces for controlling the code or the visualization, analysis modules, print module, file manager, or an archive for collecting selected data. Integration of data production and analysis is key to the task at hand. Modules communicate by a command language that is compact, easy to read, use, and extend. Every module includes a minimum set of objects to interpret certain parts of the command language, communication routines, and the capability to start the whole system (which enables developing and debugging new modules locally). The code receives input commands from a file stack, standard input, graphical user interface, an interactive viewing window, or front a module that imports data from CAD/CAM systems or Plot3D files. Graphical interface and viewing window can be used to draft or edit the geometry, to assign materials, equations, or parameters, to decompose the physical domain into blocks, to assign grid sizes, or to change the point distributions along boundaries or within a block. Routines for different types of grid generation are an integral part of the viewing windows and the numerical solvers. All objects are embedded in a hierarchy and offer a standard set of operations. For example, every object is capable of sending its status across the network or to a file, enabling scripting and restart capabilities for both computational solvers and other modules by performing one send operation on the highest level. The code is written in C++ and is driven by events. The asynchronous operation of the code components under PVM is coordinated by a central hub. Every computational solver is able to initialize or restart grid generation or computation in some block of the physical domain, to perform a given number of time steps, to receive data from the network and to send selected data to a given destination. The integration of grid generation and computation provides for adaptive grids, moving interfaces and inspection/correction of the grid quality. The current version of the code is restricted to structured grids (transfinite, control-net or elliptic). So far the code solves the heat conduction equation incompressible Navier-Stokes equations, full potential equation, and provides for gas-liquid and liquid-solid interfaces. Second-order and higher-order methods with optional multigrid acceleration have been implemented. Within a special C++ framework and coding scheme. Implementation and verification of new or modified equations is usually a matter of days. There are still many loose ends to be tied up, and ongoing efforts aim at improving the numerical solvers and the quality of the data transferred between blocks with different grids and relative motion. The available basis, however has proven versatile and capable of making many dreams of large-scale computation come true.

Author

Numerical Analysis; Turbines; Flow Characteristics; Boundary Layers; Stability; Computer Networks; Conductive Heat Transfer

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Experimental Investigation of Transition to Turbulence Under Low-Pressure Turbine Conditions: Measurements With and Without Wakes

Simon, Terrence W., Minnesota Univ., USA; Kaszeta, Richard W., Minnesota Univ., USA; Yuan, Kebiao, Minnesota Univ., USA; Ottaviani, Federico, Minnesota Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 287-311; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research was designed to address a need for detailed experimental data which document transition in boundary layers and separated flows over highly-loaded airfoils, including the effects of passing wakes. The program objectives are accomplished with the following steps: First, the effects of freestream turbulence and Reynolds number are documented without wakes in a facility which simulates the flow through a modern, highly-loaded, low-pressure turbine. Next, this case is repeated, but with the influence of simple, rod-generated wakes added. By comparing, we can identify the effects of wakes on transition in the boundary layer. We have completed the first part, Qiu and Simon and Simon et al. It shows cases with strong separation at low Reynolds numbers and low turbulence levels and cases with much smaller separation bubbles with higher Reynolds number or freestream turbulence. It shows also that a correlation for the streamwise distance from separation to the start of transition by Davis et al. is quite accurate and that a model for the intermittency path by Dhawan and Narasimha is remarkably good, in spite of its derivation

from attached boundary layer flow transition data. A need for better prediction of the transition length is indicated, however. Early results of the with-wake data were presented and comparisons were made to the no-wake study. Wakes are generated by sliding a rack of rods through the approach flow tunnel. A photogate was used to verify that the wake generator sled is moving at a uniform velocity when measurements of the flow are made. To characterize the wakes, 100 separate traverses of the sled were made and an ensemble average of 100 separate traverses of each rod was generated. We see that the minimum velocity at the center of the wake is approximately 85% of the average value, which matches the work of who used a rotating airfoil stage (simulating a rotating turbine stage) to create wake profiles, but the turbulence intensity peaks at 15%, more than twice that reported by Halstead. This may be consistent with Halstead's assertion that rods seem to produce more turbulence than airfoils of the same loss coefficient. It should be noted, however, that flow over the airfoils of the Halstead study was not strongly separated and a highly-loaded airfoil, such as that of the present study (Pak B), will be inclined to separate more strongly. The unsteady boundary layer measurements include the ensemble-averaged, period-resolved profiles of velocity, rms velocity fluctuation and intermittency over the surface. Characterization of this flow will demonstrate the influence of the passing wake on the state of the boundary layer or separated flow zone, including the "calming" region. Further, such data will allow testing of transition models which have been developed to incorporate the effects of passing wakes on transition.

Author

Experimentation; Transient Heating; Turbulence; Low Pressure; Turbines; Wakes

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Direct Simulation of Unsteady Wakes and Transition in a Turbine Passage

Durbin, P. A., Stanford Univ., USA; Wu, X., Stanford Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 312-320; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Direct numerical simulations have been performed of unsteady wake effects and of transition on a flat plate and in a turbine passage. Passing wakes were simulated by sweeping a self-similar, turbulent wake across the entrance to the computational domain. Computations were performed on a highly parallel computer with on the order of 50million grid points. The geometry and flow conditions of the turbine passage correspond to the 'T106' blade being studied in a number of laboratory experiments. Flat plate, zero pressure gradient bypass transition occurs through four stages. In the first, elongated regions of high or low velocity form near the wall. Secondly, the low velocity regions lift from the surface, producing a lifted, backward jet. This provides a receptivity path for external turbulence to enter the boundary layer; the third stage is an instability of the lifted jet. In the final stage the instability cascades to small scale, locally filling the boundary layer with a turbulent spot. At this stage transition to turbulence has occurred, although the spots subsequently evolve and merge to produce a fully turbulent boundary layer. A second set of simulations addresses the development of wakes in a low pressure turbine passage. New vortical structures were observed to evolve within the wake as it traversed the passage. They were produced by interaction between the wake and the mean straining field. An intriguing asymmetry was observed between the suction and pressure sides of the passage. It can be explained by the relative orientation of the wake and rate of strain. Streamwise elongated vortices descend from the passage and lie along the pressure surface. Secondary vortices are caused by the viscous boundary condition, leading to a set of surface vortices. Three-dimensional, small scale turbulence is amplified near the suction side. The unsteady, asymmetric, vortical field will be illustrated and discussed for its relevance to predicting turbulence and transition in turbines. Transition via spots occurs on the suction surface toward the rear edge. Some evidence was seen that in the absence of passing wakes more orderly transition occurs in the adverse pressure gradient region right before the trailing edge.

Author

Numerical Analysis; Unsteady Flow; Flat Plates; Turbulent Wakes; Boundary Conditions

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Unsteady Stator-Row Flow With Wake Passings

Smith, Frank T., University Coll., UK; Li, Lin-Zhong, University Coll., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 321-339; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This ongoing work is aimed primarily at the understanding and modelling of the unsteady flow through a vertical periodic row (stack) of stationary quasi-stator blades, as affected by the wakes from a row of quasi-rotor blades upstream which are also

vertically periodic but moving downward. The periodic wake itself is first found to generate a pressure drop ahead of the stator row. The subsequent unsteady motion within the stator row is taken to be two-dimensional and to be periodic in the vertical co-ordinate, to allow for the blade to blade interactions. This is accompanied, in a first shot, by an assumption of thin-layer and slowly-varying behaviour in order to capture the global properties of the stator motion via rapid numerical sweeps, as far as possible in a forward-marching manner. The global properties include substantial regions of adverse pressure gradient over the rear of the typical blade and almost steady separations which periodically (in time) are made unsteady by the passage of the wakes. The wakes and the stator motions can be computed together, allowing for the interactive rows. As a second shot, the influences of non-slow behaviour are incorporated in the overall approach by means of temporal or spatial lagging of their effects, for example through the normal pressure gradients, again in an attempt to keep the global numerical sweeps as rapid as possible. The effects of the typical wake thickness, the Reynolds number and the temporal period have been studied, among other main features. The above theory and computation is for laminar incompressible flow but should be extendable to turbulent and compressible flow also. The consequent development of spots initially localised and at low amplitudes is described in allied papers, particularly in the regions of adverse pressure gradient or flow reversal generated on the blade as above. The effects of vortical wake passing as an initiator, followed by nonlinear evolution, nonparallel flow evolution and the three-dimensional responses are included in the spot analysis.

Author

Unsteady Flow; Wakes; Models; Compressible Flow; Pressure Gradients

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Relaxation Following Wake Impingement on Reattaching Flow

Gostelow, J. P., Leicester Univ., UK; Allen, N. M., Leicester Univ., UK; DOvidio, A., Leicester Univ., UK; Harkins, J. A., Leicester Univ., UK; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 340-344; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Experiments are in progress aimed at direct comparisons between triggered turbulent spots and wake-induced turbulent patches on a flat plate in a low-speed wind tunnel. These are being conducted under strong adverse pressure gradients giving alternative conditions of a long laminar separation bubble, an incipient laminar separation and an early natural transition, as determined by small changes in free-stream Reynolds number. Good progress has been made on the experiments involving triggered spots and work has commenced on wake-induced turbulent patches. The purpose is to gain an appreciation of turbulent spot behavior under an adverse pressure gradient as a foundation for the improved modeling of wake-induced turbulent patches in predictions of transitional boundary layer flows on axial turbomachine blading. A substantial experimental program on triggered spots has now been completed for the long separation bubble and incipient laminar separation cases. This will give two new points which broadly confirm the existing Solomon, Walker, Gostelow spot-spreading correlation for transition length. Preliminary boundary layer traverses are presented for the case involving wake impingement on the reattachment region of a laminar separation bubble- These show the similarity between the wake interaction and the triggered turbulent spot and also the strong effect of the calmed region behind the wake interaction. The calmed region prevails behind any such disturbance whether two-dimensional or three-dimensional. Unsteady transition phenomena occurring as a result of wake interaction events on compressor and turbine blading are consistent with the behavior of triggered turbulent spots on a flat plate. Experiments on turbulent spots are directly applicable to the complex flows on compressor and turbine blading. The overall effect of the wake interaction, and the resulting calmed region, is to delay the transition process and to stabilize the boundary layer against separation. The velocity profiles show that within the impinging wake, the rms disturbance level is strong but there is little velocity perturbation from the incoming laminar layer profile. The turbulent patch behind the wake is more characteristic of a turbulent layer and shows a strong velocity perturbation from the laminar layer velocity profile. The calmed region is strong and has a more stable velocity profile than a steady laminar boundary layer under the same local pressure gradient; the amplitude of Tollmien-Schlichting (T-S) instabilities is therefore temporarily reduced and the progression to harmonic breakdown and turbulence delayed. Turbulence from the surrounding boundary layer eventually contaminates the region leading to its destruction, but this process may be quite protracted. Because of its increased wall shear stress the calmed region flow is also more resistant to separation, and this may have beneficial consequences for stall margin. Similarities have been investigated between transition through spots on a flat plate and wake-induced turbulent patches on turbine and compressor blades. In triggered spots on a flat plate transition proceeds by natural growth; small disturbance, to wave packet, to developed spot- Flat plates, turbine

cascades and rotating compressor all show natural transition with strong amplification of T-S waves. Harmonic development to turbulence then develops. The instabilities are amplified by strong adverse pressure gradients.

Author

Experimentation; Turbulent Wakes; Pressure Gradients; Laminar Boundary Layer; Bubbles; Boundary Layer Flow

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Experimental Investigation of Separated and Transitional Boundary Layers Under Low-Pressure Turbine Airfoil Conditions

Hultgren, Lennart S., NASA Glenn Research Center, USA; Volino, Ralph J., Naval Academy, USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 360-378; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modern low-pressure turbine airfoils are subject to increasingly stronger pressure gradients as designers impose higher loading in an effort to improve efficiency and to reduce part count. The adverse pressure gradients on the suction side of these airfoils can lead to boundary-layer separation, particularly under cruise conditions. Separation bubbles, notably those which fail to reattach, can result in a significant degradation of engine efficiency. Accurate prediction of separation and reattachment is hence crucial to improved turbine design. This requires an improved understanding of the transition flow physics. Transition may begin before or after separation, depending on the Reynolds number and other flow conditions, has a strong influence on subsequent reattachment, and may even eliminate separation. Further complicating the problem are the high free-stream turbulence levels in a real engine environment, the strong pressure gradients along the airfoils, the curvature of the airfoils, and the unsteadiness associated with wake passing from upstream stages. Because of the complicated flow situation, transition in these devices can take many paths that can coexist, vary in importance, and possibly also interact, at different locations and instances in time. The present work was carried out in an attempt to systematically sort out some of these issues. Detailed velocity measurements were made along a flat plate subject to the same nominal dimensionless pressure gradient as the suction side of a modern low-pressure turbine airfoil ('Pak-B'). The Reynolds number based on wetted plate length and nominal exit velocity, Re , was varied from 50,000 to 300,000, covering cruise to takeoff conditions. Low, 0.2%, and high, 7%, inlet free-stream turbulence intensities were set using passive grids. These turbulence levels correspond to about 0.2% and 2.5% turbulence intensity in the test section when normalized with the exit velocity. The Reynolds number and free-stream turbulence level do not have a significant effect on the location of boundary-layer separation unless they are high enough to induce transition upstream of separation. The location and extent of the transition zone, in contrast, depend strongly on Re and TI. The beginning of reattachment closely follows the onset of transition. Under low free-stream turbulence conditions the boundary layer is laminar at separation and then begins to exhibit fluctuations in a finite frequency band in the shear layer over the separation bubble. These fluctuations are due to instability waves. The fluctuations grow in magnitude, higher harmonics are generated, and finally lead to a breakdown to turbulence. Transition begins in the shear layer, but quickly spreads to the near wall region and causes the boundary layer to reattach. The transition is rapid and the resulting turbulence contains a full range of high and low frequencies. Under high free-stream turbulence conditions, slowly growing low-frequency fluctuations are induced in the pretransitional boundary layer by the free-stream. The separation bubbles are considerably thinner than in the low TI cases, resulting in thinner boundary layers at the end of the test wall. At $Re=50,000$ and $100,000$, the pre-transitional boundary layer separates at about the same location as in the low TI cases. Transition occurs through a bypass mode, begins upstream of the corresponding low-TI location, and proceeds in a manner similar to that of an attached boundary layer. Under high TI at $Re=200,000$ and $300,000$, transition begins before separation. The boundary layer may separate, but if it does the separation bubble is very short and does not significantly affect the downstream development of the boundary layer. A comparison is made to previous work in a simulated cascade.

Author

Experimentation; Boundary Layer Separation; Transition Flow; Low Pressure; Turbines; Airfoils; Velocity Measurement

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Global Instabilities in Laminar Separated Boundary Layer Flow

Theofilis, Vassilios, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 379-399; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over decades separated transitional flow control has focussed on amplification of incoming Tollmien-Schlichting (TS)-like disturbances and ignored the possibility of own ('eigen')-disturbances being generated by the flow itself. Evidence is accumulating that global flow instability is active in canonical laminar separated flow configurations. Failure to control this instability mechanism will render separated flow control methodologies which are based on TS-frequency information incomplete as far as travelling disturbances are concerned and inadequate for control of stationary global instabilities. In order to explore the question of existence of global linear instability in a model flow relevant to aerodynamics and turbomachinery alike, namely a laminar separation bubble set up by an analytically known adverse pressure gradient in incompressible flow, the related partial derivative nonsymmetric generalised eigenvalue problem has been solved 1. Both stationary and pairs of travelling linear instabilities have been discovered, which are distinct from known solutions of the Orr-Sommerfeld equation (OSE) or the linear parabolised stability equations (PSE) instability theories, and can both become unstable at flow parameters presented by Theofilis. The disturbance vorticity ζ of the most unstable stationary global mode is dominated by the streamwise disturbance velocity component; ζ is visualised in the following figure by a single isosurface of this quantity, drawn at an arbitrarily defined level such that the dominant features of the instability in question are illustrated. The flow direction is indicated by the arrow and the steady laminar separation and reattachment boundaries determined by the basic state are marked by dashed lines. One spanwise periodicity is shown. The innocuous primary separation line and the three-dimensionalisation of the primary reattachment line on account of the global instability mechanism is to be seen in this result. of the two layers of particles released into the flow that nearer the wall, at the height of the primary separation bubble, is seen to be trapped in the neighbourhood of reattachment on account of the global instability mechanism. Besides issues revolving around flow control, the instability mechanism discovered may well be related with and shed light to the phenomenon of vortex-shedding by laminar separation bubbles; a detailed discussion of this issue is presented. In our opinion, the significance of the present findings warrants further investigation into this problem. In order to address the issues of global instability of flows with large-scale separation on configurations relevant to both external aerodynamics and turbomachinery a new algorithm based on spectral/hp element technology has been developed and validated. Results will be presented in due course.

Author

Flow Stability; Laminar Boundary Layer; Eigenvalues; Orr-Sommerfeld Equations

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Active Control of a Transitional Separation Bubble at Low Reynolds Number and Elevated Free-Stream Turbulence

Nishri, B., Tel-Aviv Univ., Ramat-Aviv, Israel; Seifert, A., Tel-Aviv Univ., Ramat-Aviv, Israel; Wygnanski, I., Tel-Aviv Univ., Ramat-Aviv, Israel; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 400-409; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Laminar Separation of low Reynolds number adverse pressure gradient boundary layers, with subsequent turbulent reattachment frequently occurs on airfoils and on low-pressure turbine blades. It is responsible for a reduction in efficiency due to an increase in pressure drag. Elevated free-stream turbulence (FST), enhances mixing above the separation bubble and thus promotes earlier reattachment. However, in most low Reynolds number applications, elevated FST does not eliminate the bubble altogether. Therefore, one may improve the performance by actively reducing the size of the separation bubble. Experimental studies shown that laminar, transitional and turbulent separation bubbles can be effectively controlled by periodic excitation at low levels of FST. The control method relies on the successive introduction of coherent structures at frequencies that generate between one to four vortices at any instant above the bubble. These vortices amplify while propagating downstream, they enhance the mixing and thus promote reattachment. The fact that this method is successful for fully turbulent shear layers served as a basis for attempting its application in the presence of elevated FST. A feasibility study was performed and reported showing that active separation control is not hindered by the presence of elevated free-stream turbulence. Current tests use an apparatus that contains a large, transitional separation bubble, situated near the leading edge of a flat-plate (Fig. 1), because the existence of a strong adverse pressure gradient. Active control, using periodic excitation via acoustic forcing from the tunnel wall, is used to reduce the mean bubble size. The FST is increased by placing a grid at various distances upstream of the test plate leading edge (LE). The level of the FST varies from 0.3% to 11% depending on the position of the grid. The turbulence show length scale (using cross correlation between two hot-wires) for various FST levels. The spectral content of the oscillations in the free-stream and in the separated shear layer, were carefully documented in the presence and in the absence of "active flow control". It demonstrates the effect of the FST on the spectral content of the uncontrolled velocity inside and just outside the boundary layer, close to the LE. The effect of the elevated FST on the manner in which the separated shear layer is modified by the periodic excitation is documented as well. Further measurements include surface pressure distributions (Fig. 5 shows the effect of the FST on the mean C_p 's) as well as mean and fluctuating velocity profiles that are phase locked to the excitation.. Preliminary results indicate that

the average dimension of the bubble can be significantly reduced, even in the presence of elevated FST. This particularly true at the low frequency of excitation (e.g. 20Hz, corresponding to $F^+ B=1$, where the reduced frequency is based on the length of the baseline bubble and the free-stream velocity) when there is a large disparity of scales between the free stream turbulence and the imposed oscillation. At an excitation frequency of 80Hz, the effect of AFC was reduced as the FST increased. See Fig. 6 for controlled C_p 's. The effect of acoustic excitation from the tunnel wall was found to be similar to the effect of a vibrating ribbon placed near the LE of the plate. It is believed that the application of active flow control to low Reynolds number axial flow machinery has great potential for improving efficiency of a single rotor-stator stage therefore enabling a reduction of overall number of stages simplifying future design.

Author

Active Control; Bubbles; Separated Flow; Low Reynolds Number; Turbulence; Boundary Layers; Velocity Distribution; Vortices

20020067685 Technische Univ., Jet Propulsion Lab., Berlin, Germany

Stability, Transition and Reattachment Characteristics of a Separation Bubble in Unsteady Flow

Hourmouziadis, J., Technische Univ., Germany; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 410-416; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Highly loaded turbomachinery airfoils in high lift low pressure turbines as well as in compressors approaching stall demonstrate transition of the suction side boundary layer via a separation bubble. Close control of this transition process is necessary to avoid full separation with dramatic effects on performance and stability. The transition of the free shear layer is strongly affected by two unsteady external phenomena: the velocity defect in the wake of upstream blade rows and the increased turbulence levels within this wake. In most experiments both phenomena are effective simultaneously and it is not possible to determine their relative relevance. Experiments with a large-scale low-speed facility offer the opportunity of combining a closely controlled main flow with a detailed resolution of the shear layer. Such experiments have been performed in a suction type wind tunnel with a rotating flap and a contoured wall to generate the necessary pressure distribution on a flat plate. The effects of the velocity defect of the wake alone are studied in a low-turbulence environment. Typical parameters have been selected from earlier high speed turbine tests. The results offered for discussion include: 1. A comparison of the response of the separation bubble to steady and periodic main flow. 2. The development of instability waves in the free shear layer and visualization of the transition process over a full period of the main flow fluctuation applying phase-averaging to single hot wire signals. 3. The characteristic "frequency packages" of the instability waves. 4. The observed phase shift between the main flow and the separation bubble in the region of transition and reattachment. 5. The effect of Strouhal-no. on the location of transition initiation along the velocity wave of the periodic main flow.

Author

Boundary Layer Separation; Bubbles; Stability; Transition Flow; Pressure Distribution

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Simulations of Boundary Layer Development in Low-Pressure Turbines

Dorney, Daniel J., Virginia Commonwealth Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 417-439; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Recent studies have shown that low Reynolds number effects contribute to the lower efficiencies at cruise conditions. The goal of the current effort is to implement/improve existing turbulence models, natural transition models, intermittency function models and bubble transition models into two- and three- dimensional Navier-Stokes analyses. Numerical simulations have been performed for several geometries, including a low-pressure turbine cascade and a two-stage low-pressure turbine. The simulations were performed for several Reynolds numbers and turbulence levels. The predicted results have been compared with experimental airfoil loadings and boundary layer quantities. The comparisons indicate that relatively simple models can be used to predict the effects of Reynolds number variations in a low-pressure turbine environment.

Author

Boundary Layers; Navier-Stokes Equation; Data Acquisition; Engine Tests; Jet Engines

20020067687 NASA Glenn Research Center, Cleveland, OH USA

Effect of Favorable Pressure Gradients on Turbine Blade Pressure Surface Heat Transfer

Boyle, Robert J., NASA Glenn Research Center, USA; Giel, P. W., DYNACS Engineering Co., Inc., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 440-458; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent measurements on a turbine rotor showed significant relaminarization effects. These effects were evident on the pressure surface heat transfer measurements. The character of the heat transfer varied with Reynolds number. Data were obtained for exit Reynolds numbers between 500,000 and 880,000. Tests were done with a high level of inlet turbulence, 7.5%. At lower Reynolds numbers the heat transfer was similar to that for laminar flow, but at a level higher than for laminar flow. At higher Reynolds numbers the heat transfer was similar to turbulent flow, when the acceleration parameter, K , was sufficiently small. The proposed paper discusses the experimental results, and also discusses approaches to calculating the surface heat transfer for the blade surface. Calculations were done using a three-dimensional Navier-Stokes CFD analysis. The results of these tests, when compared with previous blade tests in the same facility, illustrate modeling difficulties that were encountered in CFD predictions. The two blades were in many ways similar. However, the degree of agreement between the same analysis and the experimental data was significantly different. These differences are highlighted to illustrate where improvements in modeling approaches are needed for transitional flows.

Author

Pressure Gradients; Turbine Blades; Heat Transfer; Heat Measurement; Computational Fluid Dynamics

20020067689 Aeronautical Systems Div., Propulsion Development Systems Office, Wright-Patterson AFB, OH USA

The Effect of Turbulence Length Scale on Low Pressure Turbine Blade Heat Transfer

Butler, Robert J., Aeronautical Systems Div., USA; Byerley, Aaron R., Air Force Academy, USA; VanTreuren, Kenneth, Baylor Univ., USA; Baughn, James W., California Univ., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 497-517; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unpredicted losses during high altitude operation have been observed in low pressure gas turbine stages. These losses have been attributed to separation on the suction surface of the turbine blades. To gain insight into boundary layer transition and separation for these low Reynolds number conditions, the heat transfer distribution on a Langston turbine blade shape was measured in a linear cascade wind tunnel for turbulence levels of 0.8% and 10% and Reynolds numbers of 40k to 80k. Turbulence levels of 10% were generated using three passive biplanar lattice grids with square-bar widths of 1.27 cm, 2.54 cm, and 6.03 cm to investigate the effect of turbulence length scale. The heat transfer was measured using a uniform heat flux liquid crystal technique. As turbulence levels increased, stagnation heat transfer increased and the location of the suction-side boundary layer transition moved upstream toward the blade leading edge. For this turbine blade shape the transition location did not depend on turbulence length scale, the location is more dependent on pressure distribution, Reynolds number and turbulence intensity. For the 10% turbulence cases, the smaller length scales had a larger effect on heat transfer at the stagnation point. A laser tuft method was used to differentiate between boundary layer transition and separation on the suction surface of the blade. Separation was observed for all of the low turbulence (clean tunnel) cases while transition was observed for all of the 10% turbulence cases. Separation and transition locations corresponded to local minimums in heat transfer. Reattachment points did not correspond to local maximums in heat transfer, but instead, the heat transfer coefficient continued to rise downstream of the reattachment point. For the clean tunnel cases, streamwise streaks of varying heat transfer were recorded on the concave pressure side of the turbine blade. These streaks are characteristic of Goertler vortices. For the 10% turbulence cases, these streaks were not present. The results presented in this paper show that turbulence length scale, in addition to intensity have an important contribution to turbine blade aerodynamics and are important to CFD modelers who seek to predict boundary layer behavior in support of turbine blade design optimization efforts.

Author

Turbulence Effects; Low Turbulence; Low Pressure; Turbine Blades; Computational Fluid Dynamics; Heat Transfer Coefficients

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Estimating Transition Location in the Presence of Roughness and Free-Stream Disturbances

Crouch, J. D., Boeing Commercial Airplane Co., USA; Ng, L. L., Boeing Commercial Airplane Co., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 518-535; In

English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Receptivity analysis is used in conjunction with linear stability theory to estimate the location of transition for various model-surface finishes and free-stream-disturbance environments. Tollmien-Schlichting instabilities and cross-flow instabilities are considered in the context of swept-wing transition, in low to moderate free-stream-disturbance environments. Receptivity studies include acoustic and vortical free-stream perturbations, surface roughness, and nonuniformities in surface suction. With simplifying assumptions about the receptivity, a variable n-factor method has been formulated for transition due to cross-flow instabilities. Transition is correlated with the stationary cross-flow vortices for turbulence levels characteristic of flight. At higher turbulence levels, the transition is correlated with traveling cross-flow instabilities. In both cases, the n-factors vary with the surface-roughness level, consistent with a simplified model of non-localized receptivity at the instability neutral points.

Author

Estimating; Transition Flow; Vortices; Turbulent Flow

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Effect of a Roughness Element on Development of the Viscous Layer for a Turbulent Boundary Layer

Becker, S., Erlangen-Nuernberg Univ., Germany; Condie, K. G., Idaho National Engineering and Environmental Lab., USA; Stoots, C. M., Erlangen-Nuernberg Univ., Germany; McEligot, D. M., Idaho National Engineering and Environmental Lab., USA; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 536-561; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In many technical applications, laminar boundary layers are induced, by roughnesses, to undergo transition to a turbulent flow at lower Reynolds numbers than the natural flow transition. The present studies were undertaken to extend the knowledge of the spatial and temporal structure of the transition process induced by a single square roughness element. Particular emphasis was placed on the evolution of the viscous layer since it usually dominates the convective resistance to heat transfer (and momentum transfer) to/from a surface. The aim is to reach a better understanding of the fluid physics structure which evolves in a transition process induced by roughnesses, especially in the near-wall region. The results should also be valuable for benchmarking Direct Numerical Simulations of transition enhanced by the presence of roughness elements. To measure the wall-normal component close to the surface, two-component laser Doppler anemometry (LDA) was used with the INEEL Matched-Index-of-Refraction (MIR) flow system. With hot-wire and hot-film X- or slant-probes to deduce Reynolds shear stresses, the sensor volume required has a dimension of the order of a millimeter perpendicular to the surface plus the additional space necessary for the support prongs. With LDA, an effective sensor diameter of about 60 microns or less can be achieved so measurements can be obtained to $y = 30$ microns before "intersecting" the surface. However, the wall can interfere with the laser beams of an LDA system, especially when systems for two- and three-component measurements are employed. One way to eliminate these problems is to use a liquid possessing a refractive index that is matched to that of the wall material. The INEEL MIR flow system provides a basic test facility to study boundary layer transition in detail. The length of the test section is about 2.4 m and it has a cross section of about 0.61 m x 0.61 m, compared to other MIR facilities which have characteristic dimensions of a few centimeters.

Derived from text

Convective Heat Transfer; Flow Characteristics; Surface Roughness; Turbulent Boundary Layer; Viscoelasticity

20020067692 Royal Inst. of Tech., Heat and Power Technology, Stockholm, Sweden

A Basic Nozzle Test Facility for Fluid-Structure Interaction in Transonic Flow

Fransson, T. H., Royal Inst. of Tech., Sweden; Bron, O., Royal Inst. of Tech., Sweden; Minnowbrook III: 2000 Workshop on Boundary Layer Transition and Unsteady Aspects of Turbomachinery Flows; April 2002, pp. 562-607; In English; Also announced as 20020067662; The conference proceeding is available in Hardcopy and CD-ROM. The hardcopy contains only abstracts of the papers while the CD-ROM contains viewgraphs of each presentation

Contract(s)/Grant(s): STEM Proj. 6303; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A prerequisite for aeroelastic stability investigations in turbomachines is the understanding of the aerodynamic forces acting on the blades. In order to obtain precise insight into aeroelastic phenomena associated with oscillating shock waves, fundamental experiment to further understand the behaviour of travelling pressure waves in non-uniform transonic flows at different operating conditions are needed. The emphasis is on the unsteady interaction of upstream propagating acoustic waves with a shock in transonic convergent-divergent nozzles at different inlet boundary layer conditions, and how this interaction can affect the unsteady pressure distribution on the surface. This presentation intends to present the facility in which those experiments are being

performed, and give an overview of the intended future modifications and investigations. Different test objects and their instrumentation will be presented as well as the first preliminary results.

Author

Performance Tests; Boundary Layers; Convergent-Divergent Nozzles; Transonic Flow; Pressure Distribution

20020068014 NASA Marshall Space Flight Center, Huntsville, AL USA

Spin-Up Instability of a Levitated Molten Drop in MHD-Flow Transition to Turbulence

Abedian, B., Tufts Univ., USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Progress in Electromagnetics Research Symposium (PIERS) Conference, 2 Jul. 2002, Cambridge, MA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

When an alternating magnetic field interacts with induced eddy currents in a conducting body, there will be a repulsive force between the body and the driving coil system generating the field. This repulsive force is the basis of electromagnetic levitation, which allows containerless processing of different materials. The eddy currents in the conducting body also generate Joule heating. Axial rotation of electromagnetically levitated objects is a common observation in levitation systems and often an undesirable side effect of such experiments on 1-g and -g. There have been recent efforts to use magnetic damping and suppress this tendency of body rotation. The first report of rotation in EML drops was attributed to a slight asymmetry of the shape and location of the levitation coils could change the axis and speed of rotation. Other theories of sample rotation include a frequency difference in the traveling electromagnetic waves and a phase difference in two different applied fields of the same frequency. All of these different mechanisms share the following characteristics: the torque is small, constant for constant field strength, and very weakly dependent on the sample's temperature and phase (solid or liquid). During experiments on the MSL-1 (First Microgravity Science Laboratory) mission of the Space Shuttle (STS-83 and STS-94, April and July 1997), a droplet of palladium-silicon alloy was electromagnetically levitated for viscosity measurements. For the non-deforming droplet, the resultant MHD flow inside the drop is inferred from motion of impurities on the surface. These observations indicate formation of a pair of co-rotating toroidal flow structures inside the spheroidal levitated drop that undergo secondary flow instabilities. As rise in the fluid temperature rises, the viscosity falls and the internal flow accelerates and becomes oscillatory; and beyond a point in the experiments, the surface impurities exhibit non-coherent chaotic motion signifying emergence of turbulence inside the drop. In this work, a background of these set of observations will be given followed by a presentation of our results on the digital particle tracking analysis that has been performed on a number of available videos. The analysis indicates that the levitated drop attains a constant rotational speed during the melting phase and formation of the co-rotating axi-symmetric laminar toroidal structures. However, the rate of axial rotation increases dramatically during the deformation of the toroidal structures anti their breakup into chaotic entities. This new data suggests an interaction between the flow inside the levitated molten drop and the driving coils in the experiments. Possible mechanisms for this interaction will be reviewed. The data will also be used to make an assessment of existing theories on droplet rotation.

Author

Drops (Liquids); Levitation; Magnetic Fields; Magnetohydrodynamic Flow; Stability; Turbulence; Spin

20020068381 Naval Research Lab., Marine Geoacoustics Div., Stennis Space Center, MS USA

Concentration Gradient, Diffusion, and Flow Through Open Porous Medium Near Percolation Threshold via Computer Simulations

Pandey, R. B.; Gettrust, J. F.; Stauffer, D.; Dec. 01, 2001; 20p; In English

Report No.(s): AD-A403937; NRL/JA/7430--01-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The interacting lattice gas model is used to simulate fluid flow through an open percolating porous medium with the fluid entering at the source-end and leaving from the opposite end. The shape of the steady-state concentration profile and therefore the gradient field depends on the porosity (p). The root mean square (rms) displacements of fluid and its constituents (tracers) show a drift power-law behavior.

DTIC

Porous Materials; Fluid Flow; Percolation; Diffusion; Gradients; Concentration (Composition)

20020068548 NASA Ames Research Center, Moffett Field, CA USA

CGNS Mid-Level Software Library and Users Guide

Poirier, Diane, NASA Ames Research Center, USA; [1998]; 1p; In English

Contract(s)/Grant(s): NAS2-13605; RTOP 538-15-11; Copyright; Avail: Issuing Activity; Abstract Only

The "CFD General Notation System" (CGNS) consists of a collection of conventions, and conforming software, for the storage and retrieval of Computational Fluid Dynamics (CFD) data. It facilitates the exchange of data between sites and

applications, and helps stabilize the archiving of aerodynamic data. This effort was initiated in order to streamline the procedures in exchanging data and software between NASA and its customers, but the goal is to develop CGNS into a National Standard for the exchange of aerodynamic data. The CGNS development team is comprised of members from Boeing Commercial Airplane Group, NASA-Ames, NASA-Langley, NASA-Lewis, McDonnell-Douglas Corporation (now Boeing-St. Louis), Air Force-Wright Lab., and ICEM-CFD Engineering. The elements of CGNS address all activities associated with the storage of data on external media and its movement to and from application programs. These elements include: - The Advanced Data Format (ADF) Database manager, consisting of both a file format specification and its I/O software, which handles the actual reading and writing of data from and to external storage media; - The Standard Interface Data Structures (SIDS), which specify the intellectual content of CFD data and the conventions governing naming and terminology; - The SIDS-to-ADF File Mapping conventions, which specify the exact location where the CFD data defined by the SIDS is to be stored within the ADF file(s); and - The CGNS Mid-level Library, which provides CFD-knowledgeable routines suitable for direct installation into application codes. The CGNS Mid-level Library was designed to ease the implementation of CGNS by providing developers with a collection of handy I/O functions. Since knowledge of the ADF core is not required to use this library, it will greatly facilitate the task of interfacing with CGNS. There are currently 48 user callable functions that comprise the Mid-level library and are described in the Users Guide. The library is written in C, but each function has a FORTRAN counterpart.

Author

Data Storage; Data Retrieval; Computer Programming; Systems Compatibility

20020068708 NASA Ames Research Center, Moffett Field, CA USA

Progress in Unsteady Turbopump Flow Simulations

Kiris, Cetin C., NASA Ames Research Center, USA; Chan, William, NASA Ames Research Center, USA; Kwak, Dochan, NASA Ames Research Center, USA; Williams, Robert, NASA Marshall Space Flight Center, USA; [2002]; 20p; In English; JANNAF 2002 Meeting, 8-12 Apr. 2002, Destin, FL, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation discusses unsteady flow simulations for a turbopump intended for a reusable launch vehicle (RLV). The simulation process makes use of computational grids and parallel processing. The architecture of the parallel computers used is discussed, as is the scripting of turbopump simulations.

CASI

Turbine Pumps; Unsteady Flow; Computational Grids; Simulation; Systems Analysis

20020068712 NASA Marshall Space Flight Center, Huntsville, AL USA

Prediction of Shock Wave Structure in Weakly Ionized Gas Flow by Solving MGD Equation

Deng, Z. T., Alabama Agricultural and Mechanical Univ., USA; Oviedo-Rojas, Ruben, Alabama Agricultural and Mechanical Univ., USA; Chow, Alan, NASA Marshall Space Flight Center, USA; Litchford, Ron J., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 33rd AIAA Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA-2002-2181; No Copyright; Avail: Issuing Activity; Abstract Only

This paper reports the recent research results of shockwave structure predictions using a new developed code. The modified Rankine-Hugoniot relations across a standing normal shock wave are discussed and adopted to obtain jump conditions. Coupling a electrostatic body force to the Burnett equations, the weakly ionized flow field across the shock wave was solved. Results indicated that the Modified Rankine-Hugoniot equations for shock wave are valid for a wide range of ionization fraction. However, this model breaks down with small free stream Mach number and with large ionization fraction. The jump conditions also depend on the value of free stream pressure, temperature and density. The computed shock wave structure with ionization provides results, which indicated that shock wave strength may be reduced by existence of weakly ionized gas.

Author

Shock Wave Profiles; Rankine-Hugoniot Relation; Predictions; Gas Flow; Ionized Gases; Normal Shock Waves

20020068794 Tennessee Univ., Dept. of Mechanical and Aerospace Engineering and Engineering Science, Nashville, TN USA

Numerical Simulation of Flow Field Within Parallel Plate Plastometer

Antar, Basil N., Tennessee Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. II-1 - II-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Parallel Plate Plastometer (PPP) is a device commonly used for measuring the viscosity of high polymers at low rates of shear in the range $10(\exp 4)$ to $10(\exp 9)$ poises. This device is being validated for use in measuring the viscosity of liquid glasses at high temperatures having similar ranges for the viscosity values. PPP instrument consists of two similar parallel plates, both in

the range of 1 inch in diameter with the upper plate being movable while the lower one is kept stationary. Load is applied to the upper plate by means of a beam connected to shaft attached to the upper plate. The viscosity of the fluid is deduced from measuring the variation of the plate separation, h , as a function of time when a specified fixed load is applied on the beam. Operating plate speeds measured with the PPP is usually in the range of 10.3 cm/s or lower. The flow field within the PPP can be simulated using the equations of motion of fluid flow for this configuration. With flow speeds in the range quoted above the flow field between the two plates is certainly incompressible and laminar. Such flows can be easily simulated using numerical modeling with computational fluid dynamics (CFD) codes. We present below the mathematical model used to simulate this flow field and also the solutions obtained for the flow using a commercially available finite element CFD code.

Derived from text

Computational Fluid Dynamics; Glass; High Polymers; Mathematical Models; Viscosity

20020068989 Argonne National Lab., IL USA

Nanofluids Can Take the Heat

2002; 14p; In English

Report No.(s): DE2002-43231; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Copper nanoparticles and carbon nanotubes have been found to enhance the thermal conductivity of base fluids dramatically. Adding 0.3 vol.% of 10-nm copper nanoparticles to ethylene glycol increased its thermal conductivity up to 40%. Nanotubes yield by far the highest thermal conductivity enhancement ever achieved in a liquid: a 150% increase in the conductivity of oil at 1 vol.% of 25-nm nanotubes. More interestingly, the thermal conductivity enhancement with the nanotubes is an order of magnitude higher than predicted by existing theories. This discovery clearly suggests that conventional heat conduction models for solid/liquid suspensions are inadequate. Several mechanisms that could be responsible for thermal transport in nanofluids have been proposed. However, the mysteries of nanoparticles in fluids remain unsolved, presenting new opportunities and challenges for scientists and engineers. Nanofluid research could lead to a major breakthrough in solid/liquid composites for numerous engineering applications, such as coolant for automobiles, air conditioning, and supercomputers.

NTIS

Nanotechnology; Conductive Heat Transfer; Ethylene Compounds

20020069098 National Aerospace Lab., Amsterdam Netherlands

Microgravity Two-Phase Flow and Heat Transfer

Delil, A. A. M.; 2001; 32p

Report No.(s): PB2002-105859; NLR-TP-99429; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multiphase flow, the simultaneous flow of the different phases (states of matter) gas, liquid and solid, strongly depends on the level and direction of gravitation, since these influence the spatial distribution of the phases, having different densities. Many current investigations concern the behavior of liquid-solid flows (e.g. in mixing, crystal growing, or materials processing) or gas-solid flows (e.g. in cyclones or combustion equipment). However, of major interest for aerospace applications are the more complicated liquid-vapor or liquid-gas flows, that are characteristic for aerospace thermal control systems, life sciences systems and propellant systems. Especially for liquid-vapor flow in aerospace two-phase thermal control systems, the phenomena become extremely complicated, because of heat and mass exchange between the two phases by evaporation or condensation. Though a huge amount of publications (textbooks, conference proceedings and journal articles) concern two-phase flow and heat transfer, publications on the impact of reduced gravity are very scarce. This is the main driver for carrying out research in microgravity. The various heat and mass transfer research issues of two-phase heat transport technology for space applications are discussed in this chapter. It is focused on the most complicated case of liquid-vapor flow with heat and mass exchange. Simpler cases, like adiabatic or isothermal liquid-vapor flow or liquid-gas flow, can straightforwardly be derived from this liquid-vapor case, as various terms in the constitutive equations can be set zero.

NTIS

Heat Transfer; Two Phase Flow; Temperature Control; Adiabatic Flow; Aerospace Engineering; Heat Transmission

20020069100 National Aerospace Lab., Amsterdam Netherlands

High-Level Versus Low-Level Do-Loop Parallelization: Results for One Testcase of a Multi-Block Solver on a Shared Memory Parallel Vector Computer

Wijnandts, P.; Vogels, M. E. S.; Nov. 1997; 22p; In English

Report No.(s): PB2002-105889; NLR-TP-9777592; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Within the NICE project, supported by the Dutch Foundation HPCN, the multi-block Navier-Stokes flow solver ENSOLV is being parallelized. In this article first results of the block-loop parallelization of ENSOLV are presented. We discuss the

performance results of this parallelization on a 16-processor NEC SX-4, a shared memory parallel vector computer. The results are compared to those of the low-level DO-loop parallelization implemented earlier. The conclusion is that for the cases with higher number of multigrid levels, the block loop parallelization gives better speed-up, requires more memory, and gives overall less execution cost.

NTIS

Parallel Processing (Computers); Loops; Memory (Computers); Navier-Stokes Equation; Parallel Computers

20020070279 MRJ Technology Solutions, Inc., Moffett Field, CA USA

3D Simulations of the Richtmyer-Meshkov Instability with Re-Shock

Meiron, Daniel I., California Inst. of Tech., USA; [1998]; 1p; In English; American Physical Society, Division of Fluid Dynamics Conference, 22-24 Nov. 1998, Philadelphia, PA, USA; Sponsored by American Physical Society, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: Issuing Activity; Abstract Only

We present results of inviscid simulations, in three dimensions, of Richtmyer-Meshkov instability for high incident shock Mach number. The growth rate of a single harmonic perturbation is quantified and compared with the results of a 2D calculation. Upon re-shock, the perturbation amplitude undergoes a phase reversal while the mean velocity of the interface is zero. Before re-shock the normalized growth rate of a 2D and 3D interface are nearly the same, but the growth rate after re-shock is significantly larger for the 3D than the 2D case. We also examine the evolution of multiple harmonic perturbations. Computational and parallelization issues of the simulation code will also be briefly discussed. The computations were done on the T3E at Pittsburgh Supercomputing Center.

Author

Computerized Simulation; Three Dimensional Models; Mach Number; Stability

20020070501 NASA Langley Research Center, Hampton, VA USA

Hypersonic Shock Interactions About a 25 deg/65 deg Sharp Double Cone

Moss, James N., NASA Langley Research Center, USA; LeBeau, Gerald J., NASA Johnson Space Center, USA; Glass, Christopher E., NASA Langley Research Center, USA; August 2002; 13p; In English

Contract(s)/Grant(s): RTOP 706-85-42-01

Report No.(s): NASA/TM-2002-211778; L-18199; NAS 1.15:211778; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the results of a numerical study of shock interactions resulting from Mach 10 air flow about a sharp double cone. Computations are made with the direct simulation Monte Carlo (DSMC) method by using two different codes: the G2 code of Bird and the DAC (DSMC Analysis Code) code of LeBeau. The flow conditions are the pretest nominal free-stream conditions specified for the ONERA R5Ch low-density wind tunnel. The focus is on the sensitivity of the interactions to grid resolution while providing information concerning the flow structure and surface results for the extent of separation, heating, pressure, and skin friction.

Author

Hypersonic Shock; Monte Carlo Method; Shock Wave Interaction; Slender Cones; Computational Fluid Dynamics

20020070583 Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

Performance Characteristics of an Extended Throat Flow Nozzle for the Measurement of High Void Fraction Multi-Phase Flows

Fincke, J. R.; 1999; 18p; In English

Report No.(s): DE2002-794333; INEEL/CON-98-01265; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An extended throat flow nozzle has been examined as a device for the measurement of very high void fraction multi-phase flows. Due to its greater density and partial contact with the wall, the equilibrium velocity of the liquid phase appreciably lags that of the lighter gas phase. The two phases are strongly coupled resulting in pressure drops across the contraction and in the extended throat that are significantly different than those experienced in single-phase flow. Information about the mass flow rates of the two phases can be extracted from the measured pressure drops. The performance of an extended throat flow nozzle has been evaluated under multi-phase conditions using natural gas and hydrocarbon liquids at 400 and 500 psi. Two hydrocarbon solvents were used as the test liquids, Isopar M(Registered) ($sp = 0.79$) and Aromatic 100(Registered) ($sp = 0.87$). These data are compared to prior air-water data at nominally 15 psi. The high and low pressure data were found to be consistent, confirming that the temperature, pressure, and size scaling of the extended throat venturi are correctly represented. This consistency allows different

sized devices to be applied under different fluid conditions (temperature, pressure, gas and liquid phase composition, etc) with confidence.

NTIS

Multiphase Flow; Performance Tests; Fluid Pressure; Mass Flow Rate; Single-Phase Flow

20020070611 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Applications of the Lattice Boltzmann Method to Complex and Turbulent Flows Final Report

Luo, Li-Shi, Institute for Computer Applications in Science and Engineering, USA; Qi, Dewei, University of Western Michigan, USA; Wang, Lian-Ping, Delaware Univ., USA; July 2002; 12p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2002-211659; NAS 1.26:211659; ICASE-2002-19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We briefly review the method of the lattice Boltzmann equation (LBE). We show the three-dimensional LBE simulation results for a non-spherical particle in Couette flow and 16 particles in sedimentation in fluid. We compare the LBE simulation of the three-dimensional homogeneous isotropic turbulence flow in a periodic cubic box of the size 1283 with the pseudo-spectral simulation, and find that the two results agree well with each other but the LBE method is more dissipative than the pseudo-spectral method in small scales, as expected.

Author

Boltzmann Transport Equation; Isotropic Turbulence; Three Dimensional Flow; Turbulent Flow; Computational Fluid Dynamics; Computerized Simulation

20020070681 Swedish National Testing and Research Inst., Boras, Sweden

Characterisation of a System that Measures Gas Samples Using a Mass Flow Meter

Loefstroem, P.; 1999; 62p; In English

Report No.(s): PB2002-105031; SP-RAP-1999:12; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Preparatory work for a gravimetric in situ calibration procedure A calibration method has been prepared for a new constructed gas cylinder filling station based on a mass flow measurement technique. The construction is located at AGA Gas AB special gas factory in Lidings, Stockholm, Sweden. Several investigations have been performed on the system and different parameters such as pressure, gas density, and amount of added gas has been analyzed. The calibration method gave a total measurement uncertainty of + or = 281 mg for Nitrogen, + or = 368 mg for Argon and + or = 162 mg for Helium. The principal results of the investigations are: (1) The mass flow meter error is not proportional to the amount of filled gas. (2) The gas filling system is almost always filling over the nominal value, which bothering leads to deviations from the nominal concentration in a gas mixture. (3) A low flow rate causes larger mass flow meter errors. (4) The deviation from the nominally set value increases with line (input) pressure. (5) The mass flow meter error depends on the gas density.

NTIS

Gases; Calibrating; Gas Mixtures; Flowmeters; Flow Measurement

35

INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.

20020067799 Physics and Electronics Lab. TNO, The Hague, Netherlands

Modelling of CCD Camera Applications Final Report

Franken, E. M., Royal Netherlands Army, Netherlands; April 2002; 116p; In English

Contract(s)/Grant(s): A98/KL/823; TNO Proj. 28427

Report No.(s): TD-01-0287; FEL-00-A089; Copyright; Avail: Issuing Activity

In this project a camera model is developed for CCD cameras, as part of the end-to-end electro-optical imaging chain. At the current status of the model, standard B/W CCD cameras can be modelled. However, the model can be extended towards more complex cameras, including color cameras. The camera model can be used for training purposes, for evaluation of camera systems

and for advising in the development or acquisition trajectory of new camera systems. The model has not yet experimentally been validated.

Author

CCD Cameras; Electro-Optics; Modularity; Computer Programs; Image Processing; Computerized Simulation

20020068799 Kansas State Univ., Engineering Technology Dept., KS USA

Distributed I/O Control System Implementation for the 1238 Optical Witness Sample Thermoelectric Quartz Crystal Microbalance Thermal Vacuum Bakeout Chamber

Buchanan, Randy K., Kansas State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. VII-1 - VII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The 1238 Thermal Vacuum Bakeout Chamber is used to test materials to determine if they meet space program contamination requirements. The system was previously manual in its operation, in that there was no supervisory control system and therefore, no means for automated operation. Marshall Space Flight Center (MSFC) requested that its operation be automated. The subsequent process implemented involved a hybrid scenario that included existing hardware, a distributed input and output (I/O) system and a graphical user interface (GUI).

Author

Contamination; Distributed Parameter Systems; Vacuum Chambers; Automatic Control; Control Systems Design

20020068817 Alabama Agricultural and Mechanical Univ., Physical Dept., Normal, AL USA

Holographic Gratings for Optical Processing

Kukhtarev, Nikolai, Alabama Agricultural and Mechanical Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXVII-1 - XXVII-9; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Investigation of astronomical objects and tracking of man-made space objects lead to generation of huge amount of information for optical processing. Traditional big-size optical elements (such as optical telescopes) have a tendency for increasing aperture size in order to improve sensitivity. This tendency leads to increasing of weight and costs of optical systems and stimulate search for the new, more adequate technologies. One approach to meet these demands is based on developing of holographic optical elements using new polymeric materials. We have investigated possibility to use new material PQ-PMMA (phenantrenequinone-doped PMMA (Polymethyl Methacrylate)) for fabrication of highly selective optical filters and fast spatial-temporal light modulators. This material was originally developed in Russia and later was tested in CalTech as a candidate material for optical storage. Our theoretical investigation predicts the possibility of realization of fast spatial and temporal light modulation, using volume reflection-type spectral filter. We have developed also model of holographic-grating recording in PQ-PMMA material, based on diffusional amplification. This mechanism of recording allow to receive high diffraction efficiency during recording of reflection-type volume holographic grating (holographic mirror). We also investigated recording of dynamic gratings in the photorefractive crystals LiNbO₃ (LN) for space-based spectroscopy and for adaptive correction of aberrations in the telescope's mirrors. We have shown, that specific 'photogalvanic' mechanism of holographic grating recording in LN allow to realize recording of blazed gratings for volume and surface gratings. Possible applications of dynamic gratings in LN for amplification of images, transmitted through an imaging fiber guide was also demonstrated.

Author

Holographic Optical Elements; Doped Crystals; Polymethyl Methacrylate; Mathematical Models; Gratings (Spectra); Imaging Techniques

20020068974 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Long Duration Flight of the TopHat Experiment

Silverberg, R., NASA Goddard Space Flight Center, USA; Aguirre, J., Chicago Univ., USA; Bezair, J., Chicago Univ., USA; Cheng, E., NASA Goddard Space Flight Center, USA; Cordone, S., Wisconsin Univ., USA; Christensen, P. R., Danish Space Research Inst., Denmark; Cottingham, D., Global Science and Technology, Inc., USA; Crawford, T., Chicago Univ., USA; Fixsen, D., Science Systems and Applications, Inc., USA; Meyer, S. S., Chicago Univ., USA; [2002]; 1p; In English; SPIE Meeting, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

TopHat is a balloon-borne instrument designed to operate on the top of a balloon. From this location, the experiment could efficiently observe using a clean beam with extremely low sidelobes. The experiment was designed to scan a large portion of the sky directly above it and to map the anisotropy of the Cosmic Microwave Background (CMBR) and thermal emission from

galactic dust. The instrument used a one meter class telescope with a five band single pixel radiometer spanning the frequency range from 150-600 GHz. The radiometer used bolometric detectors operating at approx. 250 mK. Here, we will report on the flight of the TopHat experiment over Antarctica in January, 2001 and describe the scientific goals, the operation, and in-flight performance.

Author

Balloon-Borne Instruments; Thermal Emission; Background Radiation; Dust

36

LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.

20020067724 NASA Ames Research Center, Moffett Field, CA USA

Transverse Mode Dynamics and Ultrafast Modulation of Vertical-Cavity Surface-Emitting Lasers

Ning, Cun-Zheng, NASA Ames Research Center, USA; May 04, 2002; 6p; In English; Optoelectronics and Communications Conference, Jul. 2002, Yokohama, Japan

Contract(s)/Grant(s): DTT559-99-D-00437; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We show that multiple transverse mode dynamics of VCSELs (Vertical-Cavity Surface-Emitting Lasers) can be utilized to generate ultrafast intensity modulation at a frequency over 100 GHz, much higher than the relaxation oscillation frequency. Such multimode beating can be greatly enhanced by taking laser output from part of the output facet.

Author

Surface Emitting Lasers; Laser Outputs; Frequency Modulation; Semiconductor Lasers

20020067752 JAYCOR, San Diego, CA USA

Fiber Laser Array Final Report

Simpson, Thomas B.; Jan. 2002; 56p; In English

Report No.(s): AD-A403729; AFRL-DE-TR-2001-1090; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Investigations of the coherent combining of fiber lasers using intracavity coupling have focused on the use of the Talbot effect, an external master oscillator, and the use of coherent coupling to create nonlinear, i.e., field-dependent, loss within the coupled laser array. During this program, Jaycor focused on the construction and use of an experimental apparatus that can be used to investigate the coherent combination of an array of fiber lasers. The apparatus was designed to emphasize reconfiguration flexibility and permit a wide range of key parameters to be varied. These include key laser cavity parameters, such as gain and output coupling, and key array parameters, such as the amplitude and phase of mutually coupled fields. Coherent intracavity coupling of large arrays is complicated by the presence of multiple longitudinal modes that can be simultaneously supported by the individual lasers. These individual modes do not, in general, have the same optical frequencies as one moves across the elements. While two element arrays can be easily operated in a coherent fashion, four element arrays showed a lower fraction of coherent power and greater sensitivity to fluctuations of the laboratory environment.

DTIC

Laser Arrays; Fibers; Coherent Radiation; Laser Cavities

20020068013 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Carrier Dynamics In Mid-Infrared Quantum Well Lasers Using Time-Resolved Photoluminescence

Gorski, Steven M.; Mar. 2002; 93p; In English; Original contains color images

Report No.(s): AD-A404168; AFIT/GAP/ENP/02M-01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Research in mid-infrared laser technology has uncovered numerous applications for commercial and government use. A limiting factor for mid-infrared semiconductors is nonradiative recombination, which is a process that produces excess heat without emitting a photon. Nonradiative recombination mechanisms occur over a short time period and difficult to measure. Growth methods have significantly reduced the nonradiative recombination in some materials. The objective of this research is to further the understanding of how quantum well structures impact carrier recombination. InAsSb/InAlSb and InAs/ GaInSb quantum well structures were studied with time-resolved photoluminescence utilizing upconversion, a non-linear wave mixing technique. This research reports Shockley-Read-Hall, radiative, and Auger recombination coefficients at 77k. The luminescence rise times of type I and type II structures are also compared. The number of states available within the quantum well was found

to dictate how quickly carriers were able to recombine radiatively. Finally, spectral data was taken to examine the spectral decay of the luminescence. Carrier temperatures were extracted from the spectral data. Type I structures were found to have hotter carrier temperatures and higher Auger coefficients than type II structures.

DTIC

Semiconductor Lasers; Quantum Wells

20020068033 Massachusetts Inst. of Tech., Cambridge, MA USA

Raman Echo Data Storage in Pr:YSO Crystals for High Speed Imaging Final Report, May 1997-May 1998

Shahriar, Selim; May 1998; 17p; In English

Contract(s)/Grant(s): F30602-97-C-0136; Proj-2305

Report No.(s): AD-A404024; AFRL-SN-HS-TR-2002-031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have demonstrated a ring cavity layer using the gain mechanism of a four-wave mixing process, mediated by two-photon Zeeman coherence resulting from coherent population trapping in a rubidium vapor cell. The cell acts as an amplifying phase conjugate mirror at one corner of the ring cavity. Even though the fundamental process requires non-degeneracy between the probe and the conjugate in the atom's frame, they are degenerate in the laboratory frame, via selection of a moving band of atoms for the gratings. As such, no frequency shifting is necessary in the cavity. The polarization orthogonality of the probe and the conjugate is compensated by an intra-cavity quarter wave plate.

DTIC

Raman Spectra; Four-Wave Mixing; Imaging Techniques; Data Storage

20020068089 Massachusetts Inst. of Tech., Cambridge, MA USA

Multi-Spectral Components for Ladar Final Report, Sep. 2000-Mar. 2002

Shahriar, Selim; Shaoul, Ezekiel; Mar. 2002; 15p; In English

Contract(s)/Grant(s): F19628-00-C-0074; AF Proj. 4600

Report No.(s): AD-A404053; AFRL-SN-HS-TR-2002-029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project was to explore the development of multi-spectral detectors and sources for a ladar system using two-photon resonant as well as other techniques. To this end, we have made substantial progress.

DTIC

Laser Range Finders; Optical Radar; Detectors; Fiber Optics

20020068097 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

Establishing a Facility for Making Non-Intrusive, Near-Real-Time Electric Propulsion Thruster Erosion Measurements via Simultaneous Two-Frequency Laser Induced Fluorescence Final Report, Apr. 2000-Sep. 2001

Gallimore, Alec D.; Jun. 2002; 15p; In English

Contract(s)/Grant(s): F49620-00-1-0201; AF Proj. 3484

Report No.(s): AD-A404126; AFRL-SR-AR-TR-02-0224; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DURIP funds were used to purchase three cryopumps, a state-of-the-art tunable-diode laser, a dye-to-Ti:sapphire conversion kit for a ring laser (for enhanced IR capability), and a commercial ion-sputtering source. The new cryopumps increased the xenon pumping speed of the Large Vacuum Test Facility (LVTF) at the University of Michigan's Plasmadynamics and Electric Propulsion Laboratory (PEPL) from 140,000 to 240,000 l/s. The new lasers will be used in conjunction with our tunable ring laser to make Two-Wavelength Simultaneous Laser Induced Fluorescence (TWSLIF) measurements for Hall thruster discharge channel erosion characterization. TWSLIF will first be demonstrated in a smaller vacuum facility with a commercial ion source and a boron nitride substrate. Once perfected in the smaller chamber, TWSLIF will be used in the LVTF to characterize discharge channel erosion of the P5 Hall thruster. This capability will not only enhance PEPL, but will establish a national facility where thruster erosion and spacecraft integration issues are investigated.

DTIC

Laser Induced Fluorescence; Erosion; Thrusters; Cryopumping; Electric Propulsion

20020070366 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Laser Cutting and Size Reduction. Deactivation and Decommissioning Focus Area

Sep. 2001; In English

Report No.(s): DE2002-793532; DOE/EM-0612; No Copyright; Avail: National Technical Information Service (NTIS)

The project utilizes a Neodymium Yttrium Aluminum Garnet (Nd:YAG) laser to cut and size reduce equipment in the 324 Laboratory B Hot Cell located at Pacific Northwest National Laboratory. This project will demonstrate the ability of the Nd:YAG laser to remotely and safely dismantle equipment faster, cheaper, and more efficiently than baseline cutting methods, such as the plasma torch and the water knife, in a highly radioactive area using fiber optics.

NTIS

Neodymium Lasers; Radioactive Materials; Laser Cutting; Deactivation

37

MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.

20020068066 Naval Academy, Div. of Engineering and Weapons, Annapolis, MD USA

Active Control of Fan Noise in Ducts Using Magnetic Bearings

Nelson, Jonathan P.; May 06, 2002; 70p; In English

Report No.(s): AD-A403756; 299-(2002); No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this project was to investigate global noise attenuation of narrow band fan noise in an air duct through the use of magnetic bearings. An axial flow fan creates tonal noise related to its rotational rate. Additional noise exists due to harmonics of this frequency as well as turbulent airflow. In addition to conventional brush bearings to support the fan shaft radially, this project used an active magnetic thrust bearing to control axial movement. The thrust bearing primarily functioned as an active sound control actuator. Active sound control is the method of achieving destructive interference of sound waves by outputting a secondary wave of equal amplitude and frequency, but 180 degrees out of phase with the primary wave. An error microphone was positioned in the duct to provide feedback to a Digital Signal Processor (DSP), which contained the active sound control program, while a performance microphone tested for global sound control at various points along the duct. Instead of using a secondary speaker, this project used the fan itself to collate the primary and secondary sound sources. Therefore, global sound control throughout the duct was theoretically possible. This project demonstrated this global control of noise experimentally.

DTIC

Active Control; Fan Blades; Magnetic Bearings; Noise Reduction; Shafts (Machine Elements); Air Ducts

20020068460 Lockheed Martin Space Systems Co., USA

FSW of Tapered Thickness Welds using an Adjustable Pin Tool

Adams, Glynn, Lockheed Martin Space Systems Co., USA; Venable, Richard, Lockheed Martin Space Systems Co., USA; Lawless, Kirby, NASA Marshall Space Flight Center, USA; [2002]; 22p; In English; AEROMAT 2002, 10-13 Jun. 2002, Orlando, FL, USA

Contract(s)/Grant(s): NAS8-00016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation describes the advantages of tapered thickness welds in FSW (friction stir welding), the structure of FSW welds, the adjustable pin tool used in FSW. Other topics described include compliance and temperature measurement in a FSW system, loads and torque upon the pin tool and its ability to penetrate different metals, and the results and metallurgy of FSW welds.

CASI

Friction Stir Welding; Elastic Properties; Loads (Forces); Tapering

20020068801 Tennessee Technological Univ., Dept. of Mechanical Engineering, Cookeville, TN USA

Dynamic Analysis of Capture Devices for Momentum Exchange with Tethers

Canfield, Stephen, Tennessee Technological Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. IX-1 - IX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

One of the significant challenges in developing a momentum exchange / electrodynamic reboost tether system is in the analysis and design of the capture device and its effects on the overall dynamics of the system. The goal of this work is to develop appropriate tether momentum exchange models that can simulate and evaluate the requirements of such a system, and be used to create specifications on the design of a capture device. This report briefly describes dynamic model development, simulation

of the momentum exchange process, evaluation of dynamic effects of errors in the momentum exchange process, and the development of guidelines in selecting dynamic properties in the design of a capture device.

Author

Momentum Transfer; Tethering; Design Analysis; Tetherlines; Orbital Rendezvous

20020068820 South Dakota State Univ., Mechanical Engineering Dept., Brookings, SD USA

Finite Element Modeling of Deployment, and Foam Rigidization of Struts and Quarter Scale Shooting Star Experiment

Leigh, Larry, Jr., South Dakota State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXX-1 - XXX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Inflated cylindrical struts constructed of kapton polyimide film and rigidized with foam have considerable practical application and potential for use as components of inflatable concentrator assemblies, antenna structures and space power systems. Because of their importance, it is of great interest to characterize the dynamic behavior of these components and structures both experimentally and analytically. It is very helpful to take a building-block approach to modeling and understanding inflatable assemblies by first investigating in detail the behavior of the components such as the struts. The foam material used for rigidization of such cylinders has varying modulus, which is a function of different factors, such as density of the foam. Thus, the primary motivation of the tests and analytical modeling efforts was to determine and understand the response of foam-rigidized cylinders for different densities, sizes, and construction methods. In recent years, inflatable structures have been the subject of renewed interest for space applications such as communications antennae, solar thermal propulsion, and space solar power. A major advantage of using inflatable structures in space is that they are extremely lightweight. This makes inflatables a perfect match for solar thermal propulsion because of the low thrust levels available. An obvious second advantage is on-orbit deployability and subsequent space savings in launch configuration. It can be seen that inflatable cylindrical struts and torus are critical components of structural assemblies. In view of this importance, structural dynamic and static behaviors of typical rigidized polyimide struts are investigated in this paper. The paper will focus on the finite element models that were used to model the behavior of the complete solar collector structure, and the results that they provided, as compared to test data.

Derived from text

Finite Element Method; Kapton (Trademark); Foams; Inflatable Space Structures; Spacecraft Structures; Struts; Cylindrical Shells

20020068830 Virginia Univ., Dept. of Physics, VA USA

The Effect of Friction on Penetration in Friction Stir Welding

Rapp, Steve, Virginia Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLIII-1 - XLIII-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

"Friction stir butt welding," as it was originally termed by Wayne Thomas and Christopher Dawes, in the early 1990s, but now commonly called "friction stir welding," has made great progress as a new welding technique. Marshall Space Flight Center has been investigating the use of FSW for assembly of the Shuttle's external fuel tank since the late 1990s and hopes to have the process in use by the summer of 2002. In FSW, a cylindrical pin tool of hardened steel, is rotated and plunged into the abutting edges of the parts to be joined. The tool is plunged into the weldment to within about .050 in of the bottom to assure full penetration. As the tool moves along the joint, the tool shoulder helps produce frictional heating, causing the material to plasticize. The metal of the two abutting plates flows from the front of the tool to the back where it cools and coalesces to form a weld in the solid phase. One quarter inch thick plates of aluminum alloy 2219 were used in this study. Two samples, each consisting of two 4 in x 12 in plates, were friction stir welded. The anvil for one sample was coated with molybdenum sulfide, while for the other sample a sheet of roughened stainless steel was placed between the anvil and the sample. The retractable pin tool was used so that the depth of the pin tool penetration could be varied. As welding proceeded, the length of the pin tool was gradually increased from the starting point. The purpose of this investigation is to find out at what point, in the down ramp, penetration occurs. Differences in root structure of the friction stir weld due to differences in anvil friction will be observed. These observations will be analyzed using friction stir weld theory.

Derived from text

Aluminum Alloys; Metal Plates; Stainless Steels; Friction Stir Welding

20020068840 State Univ. of New York, Dept. of Materials Science and Engineering, Stony Brook, NY USA

Deformation During Friction Stir Welding

White, Henry J., State Univ. of New York, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. LIV-1 - LIV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Friction Stir Welding (FSW) is a solid state welding process that exhibits characteristics similar to traditional metal cutting processes. The plastic deformation that occurs during friction stir welding is due to the superposition of three flow fields: a primary rotation of a radially symmetric solid plug of metal surrounding the pin tool, a secondary uniform translation, and a tertiary ring vortex flow (smoke rings) surrounding the tool. If the metal sticks to the tool, the plug surface extends down into the metal from the outer edge of the tool shoulder, decreases in diameter like a funnel, and closes up beneath the pin. Since its invention, ten years have gone by and still very little is known about the physics of the friction stir welding process. In this experiment, an H13 steel weld tool (shoulder diameter, 0.797 in; pin diameter, 0.312 in; and pin length, 0.2506 in) was used to weld three 0.255 in thick plates. The deformation behavior during friction stir welding was investigated by metallographically preparing a plan view sections of the weldment and taking Vickers hardness test in the key-hole region.

Derived from text

Friction Stir Welding; Vickers Hardness; Plastic Deformation; Hardness Tests

20020068841 Michigan Technological Univ., Dept. of Mechanical Engineering and Engineering Mechanics, Houghton, MI USA
Torque Limits for Fasteners in Composites

Zhao, Yi, Michigan Technological Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. LV-1 - LV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The two major classes of laminate joints are bonded and bolted. Often the two classes are combined as bonded-bolted joints. Several characteristics of fiber reinforced composite materials render them more susceptible to joint problems than conventional metals. These characteristics include weakness in in-plane shear, transverse tension/compression, interlaminar shear, and bearing strength relative to the strength and stiffness in the fiber direction. Studies on bolted joints of composite materials have been focused on joining assembly subject to in-plane loads. Modes of failure under these loading conditions are net-tension failure, cleavage tension failure, shear-out failure, bearing failure, etc. Although the studies of torque load can be found in literature, they mainly discussed the effect of the torque load on in-plane strength. Existing methods for calculating torque limit for a mechanical fastener do not consider connecting members. The concern that a composite member could be crushed by a preload inspired the initiation of this study. The purpose is to develop a fundamental knowledge base on how to determine a torque limit when a composite member is taken into account. Two simplified analytical models were used: a stress failure analysis model based on maximum stress criterion, and a strain failure analysis model based on maximum strain criterion.

Author

Laminates; Failure Analysis; Stress Analysis; Bolts; Fiber Composites; Torque

20020069073 National Aerospace Lab., Amsterdam Netherlands

Method for Predicting the Rolling Resistance of Aircraft Tires in Dry Snow

van Es, G. W. H.; Jun. 1999; 48p; In English

Report No.(s): PB2002-105871; NLR-TP-99240; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a method for predicting the rolling resistance of aircraft tires rolling in dry snow. Knowledge about the rolling resistance on a snow-covered surface is required when complying with aircraft certification and operational rules, which account for runway surface conditions. In addition to the rules, the Joint Aviation Authorities (JAA) have issued Advisory Material Joint AMJ 25X1591, a document providing information, guidelines, and recommendations for calculating the rolling resistance of aircraft tires in dry snow. The analytical method presented in AMJ 25X1591 gives unsatisfactory results when compared to experimental data. In this paper a new method is presented for predicting the rolling resistance due to snow. This new method and the AMJ method are validated by comparing the results of both methods for single tires and full-scale aircraft with available experiments. In general, a much better agreement with experimental data is found for the new method than for the AMJ method.

NTIS

Aircraft Tires; Snow; Runway Conditions

20020070265 Honeywell Federal Mfg. and Technologies, Kansas City, MO USA

Vacuum Brazing of Beryllium Copper Components for the National Ignition Facility Final Report

Tyhurst, C. C.; Cunningham, M. A.; Jun. 2002; 24p; In English

Report No.(s): DE2002-795098; KCP-613-6544; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A process for vacuum brazing beryllium copper anode assemblies was required for the Plasma Electrode Pockels Cell System, or PEPC, a component for the National Ignition Facility (NIF). Initial problems with the joint design and wettability of the beryllium copper drove some minor design changes. Brazing was facilitated by plating the joint surface of the beryllium copper

rod with silver 0.0006 inch thick. Individual air sampling during processing and swipe tests of the furnace interior after brazing revealed no traceable levels of beryllium.

NTIS

Copper Alloys; Brazing; Beryllium; Copper

20020070529 Florida Solar Energy Center, Cape Canaveral, FL USA

Test Plan for Monitoring Cooling Coils in a Laboratory Setting. Topical Report

Shirey, D. B.; Apr. 2002; 16p; In English

Report No.(s): DE2002-794172; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this research project is to understand and quantify the moisture removal performance of cooling coils at part-load conditions. The project will include a comprehensive literature review, detailed measurement of cooling coil performance in a laboratory facility, monitoring cooling systems at several field test sites, and development/validation of engineering models that can be used in energy calculations and building simulations. This document contains the detailed test plan for monitoring cooling coil performance in a laboratory setting. Detailed measurements will be taken on up to 10 direct expansion (DX) and chilled water cooling coils in various configurations to understand the impact of coil geometry and operating conditions on transient moisture condensation and evaporation.

NTIS

Cooling Systems; Evaporation; Liquid Cooling; Loads (Forces)

38

QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

20020068952 Texas Univ., Center for Highway Materials Research, El Paso, TX USA

Calibration Procedures for Seismic and Deflection-Based Devices, Sep. 1996 - Aug. 1998

Tandon, V.; Nazarian, S.; Apr. 2000; 128p; In English

Report No.(s): PB2002-106317; RR-2984-S1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

TXDOT has acquired fifteen Falling Weight Deflectometers (FWD), one Seismic Pavement Analyzer (SPA), and five Portable Seismic Pavement Analyzers (PSPA) for evaluating the structural integrity of pavements. These nondestructive testing devices use different types of sensors for measuring deflection, travel time and load intensity. The accuracy and precision levels of these devices diminish over the years due to wear and tear of the testing devices. Thus, it is essential to develop calibration procedures for these sensors. The primary function of the FWD device is to measure a deflection basin due to a load imparted to the pavement. Velocity transducers (a.k.a. geophones) are used to determine the deflection, and load cells are utilized to measure the applied load. The SPA uses several accelerometers and geophones to measure the propagation of waves and the deformation of pavements due to imparted loads. Load cells are used to measure the loads applied to the pavement. The PSPA only uses accelerometers to measure wave propagation patterns. Calibration procedure for three different sensors: (a) accelerometers, (b) geophones, and (c) load cells, which are essential for accurate and precise structural evaluation of pavements, have been developed as part of this study. The unique features of the proposed procedures are that: (1) each sensor is calibrated in place as a system, (2) none of the devices has to be disassembled for calibration, and (3) any desired frequency range and amplitude can be conveniently reproduced.

NTIS

Detectors; Wave Propagation; Structural Failure; Calibrating; Time Measurement

20020069084 National Inst. of Standards and Technology, Office of Weights and Measures Program, Gaithersburg, MD USA

Overview of the Recommended Guide for Determining and Reporting Uncertainties for Balances and Scales

Miller, V. R.; Jan. 2002; 24p; In English

Report No.(s): PB2002-104693; NISTIR-6855; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As scale and balance service organization have become ISO 9000 registered or accredited to ISO Guide 25 and ANSI/NCSL Z540-1-1994, now implemented as ISO/IEC 17025, the number of requests for assistance in calculating the uncertainty of a scale or balance calibration have dramatically increased. It has become evident that a practical guide is needed to explain the calculation of uncertainty in a manner unable by field service personnel who are not trained statisticians. ISO/IEC 17025 states that a calibration laboratory or testing laboratory performing calibrations shall have and shall apply a procedure to estimate the uncertainty of measurement for all calibrations. This guide will attempt to clarify the concepts of calculating scale or balance

calibration uncertainty, by providing specific examples, and making the interpretation of the various methodologies understandable to field personnel.

NTIS

Balancing; Weight Measurement

20020070599 National Inst. of Standards and Technology, Mathematical and Computational Sciences Div., Gaithersburg, MD USA

Comparative Statistical Analysis of Test Parts Manufactured in Production Environments

Gilsinn, D. E.; Ling, A. V.; Jun. 2002; 104p; In English

Report No.(s): PB2002-104233; NISTIR-6868; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Estimating error uncertainties arising in parts produced on machine tools in production machine shops is not a well understood process. The current study details a process of estimating these error uncertainties. A part with significant features was defined and a vertical turning center was selected in a production shop to make multiple copies of the part. Machine tool error components were measured using a laser ball bar instrument. Twenty-one copies of the part were produced and measured on a coordinate measuring machine. A machine tool error model based on the measurements of the vertical turning center machine tool errors was developed. Uncertainty estimates of the errors in the working volume were calculated. From coordinate measuring machine data error uncertainties at points on the part were developed. Distances between hole centers were computed and uncertainty estimates of these lengths generated. Many of the hole centers were designed to fall along orthogonal lines. Uncertainty estimates were computed of the orthogonality of these lines. All of these estimated uncertainties were compared against uncertainties computed from the measured parts. The main conclusion of the work is that the Law of Propagation of Uncertainties can be used to estimate machining uncertainties and that predicted uncertainties can be related to actual part error uncertainties.

NTIS

Drilling; Machine Tools; Error Analysis; Production Engineering

39

STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20020068041 NASA Langley Research Center, Hampton, VA USA

Equivalent Linearization Analysis of Geometrically Nonlinear Random Vibrations Using Commercial Finite Element Codes

Rizzi, Stephen A., NASA Langley Research Center, USA; Muravyov, Alexander A., NASA Langley Research Center, USA; July 2002; 39p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2294; RTOP 522-63-11-03

Report No.(s): NASA/TP-2002-211761; NAS 1.60:211761; L-18219; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two new equivalent linearization implementations for geometrically nonlinear random vibrations are presented. Both implementations are based upon a novel approach for evaluating the nonlinear stiffness within commercial finite element codes and are suitable for use with any finite element code having geometrically nonlinear static analysis capabilities. The formulation includes a traditional force-error minimization approach and a relatively new version of a potential energy-error minimization approach, which has been generalized for multiple degree-of-freedom systems. Results for a simply supported plate under random acoustic excitation are presented and comparisons of the displacement root-mean-square values and power spectral densities are made with results from a nonlinear time domain numerical simulation.

Author

Linearization; Acoustic Excitation; Finite Element Method; Random Vibration; Optimization; Mathematical Models

20020068810 Lipscomb Univ., Physics and Engineering Dept., Nashville, TN USA

An Investigation into the Potential Application of Wavelets to Modal Testing and Analysis

Gwinn, A. Fort, Jr., Lipscomb Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XIX-1 - XIX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The analysis of transient data of the type found in vibrating mechanical systems has been greatly improved through the use of modern techniques such as Fourier analysis. This is especially true when considered in conjunction with the development of the so-called Fast Fourier Transform algorithm by Cooley and the tremendous strides in computational power of the last several decades. The usefulness of the discrete Fourier Transform is its ability to transform sampled data from the "time-domain" to the "frequency domain," thereby allowing the analyst to decompose a signal into its frequency content. More recent developments have led to the wavelet transform. The strength of wavelet analysis is its ability to maintain both time and frequency information, thus making it an attractive candidate for the analysis of non-stationary signals. This report is an overview of wavelet theory and the potential use of the wavelet transform as an alternative to Fourier analysis in modal identification.

Author

Wavelet Analysis; Fourier Analysis; Frequency Domain Analysis; Time Domain Analysis; Modes (Standing Waves)

20020068827 Oakwood Coll., Mathematics and Physics Dept., Huntsville, AL USA

Monitoring of Structural Integrity of Composite Structures by Embedded Optical Fiber Sensors

Osei, Albert J., Oakwood Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXIX-1 - XXXIX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Real time monitoring of the mechanical integrity and stresses on key aerospace composite structures like aircraft wings, walls of pressure vessels and fuel tanks or any other structurally extended components and panels as in space telescopes is very important to NASA. Future military and commercial aircraft as well as NASA space systems such as Space Based Radar and International Space Station will incorporate a monitoring system to sense any degradation to the structure. In the extreme flight conditions of an aerospace vehicle it might be desirable to measure the strain every ten centimeters and thus fully map out the strain field of a composite component. A series of missions and vehicle health management requirements call for these measurements. At the moment thousands of people support a few vehicle launches per year. This number can be significantly reduced by implementing intelligent vehicles with integral nervous systems (smart structures). This would require maintenance to be performed only as needed. Military and commercial aircrafts have an equally compelling case. Maintenance yearly costs are currently reaching astronomical heights. Monitoring techniques are therefore required that allow for maintenance to be performed only when needed. This would allow improved safety by insuring that necessary tasks are performed while reducing costs by eliminating procedures that are costly and not needed. The advantages fiber optical sensors have over conventional electro-mechanical systems like strain gauges have been widely extolled in the research literature. These advantages include their small size, low weight, immunity to electrical resistance, corrosion resistance, compatibility with composite materials and process conditions, and multiplexing capabilities. One fiber optic device which is suitable for distributed sensing is the fiber Bragg grating (FBG). Researchers at NASA MSFC are currently developing techniques for using FBGs for monitoring the integrity of advanced structural materials expected to become the mainstay of the current and future generation space structures. Since carbon-epoxy composites are the materials of choice for the current space structures, the initial study is concentrated on this type of composite. The goals of this activity are to use embedded FBG sensors for measuring strain and temperature of composite structures, and to investigate the effects of various parameters such as composite fiber orientation with respect to the optical sensor, unidirectional fiber composite, fabrication process etc., on the optical performance of the sensor. This paper describes an experiment to demonstrate the use of an embedded FBG for measuring strain in a composite material. The performance of the fiber optic sensor is determined by direct comparison with results from more conventional instrumentation.

Author

Composite Structures; Bragg Gratings; Smart Materials; Strain Measurement; Optical Fibers

20020069102 National Aerospace Lab., Amsterdam Netherlands

Description of Crack Growth on the Basis of the Strip-Yield Model for Computation of Crack Opening Loads, the Crack Tip Stretch and Strain Rates

de Koning, A. U.; ten Hoeve, H. J.; Henriksen, T. K.; Jan. 1999; 28p; In English

Report No.(s): PB2002-105877; NLR-TP-97511-L; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nowadays, the application of the STRIP-YIELD model for computation of crack opening load levels is well known. In this paper the incremental formulation of a fatigue crack growth law is used to demonstrate the role of the crack opening load level in time independent fatigue crack growth. Less known is the ability of the STRIP-YIELD model to define the strain rate at the crack tip. The model discussed in this paper is a mechanical model. Physical aspects other than the strain rate, the loading frequency and load wave shape are not modelled in an explicit way. Hence, the model is valid for specific environment/base metal combinations. However, in a consideration of the effects of small variations of environment, temperature and other variables on

the crack growth rates, it can be used as a reference solution. The fatigue crack growth model has been implemented in the NASGRO (ESACRACK) software. The time dependent part is still subject of further evaluation.

NTIS

Crack Propagation; Crack Tips; Mathematical Models; Aircraft Construction Materials; Strain Rate

20020069108 Pennsylvania Transportation Inst., University Park, PA USA

Evaluation of Erection Procedures of the Horizontally Curved Steel I-Girder Ford City Veterans Bridge Final Report, 10 - Jul.-00-9-Mar.-02

Chavel, B. W.; Earls, C. J.; Kepler, W.; Mar. 2002; 532p; In English

Report No.(s): PB2002-107954; PTI-2002-23; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

In the case of horizontally steel curved I-girder bridges, it is important to carefully analyze the erection sequence of the superstructure so as to ensure that difficulties do not arise in the field during construction of the bridge. Generally, problems with curved girder bridges results from unwanted displacements, stresses, and instabilities that occur during erection. For this reason, the bridge engineer should explore a variety of erection sequences to ensure each phase of construction proceeds as anticipated to make certain that the steel superstructure satisfies the intended design parameters (i.e. deck elevations, girder web plumbness, etc.). Additional construction difficulties can result from inconsistent detailing of cross-frame members, which are primary load carrying members in steel curved I-girder bridges. Given that horizontally curved I-girders deflect vertically and horizontally upon loading, the web of the girders cannot remain plumb both before and after load is applied. An inconsistency occurs when the design engineer, the bridge erector, or the owner desires to have the web of the girders plumb before and after erection. For example, if the girders are fabricated to fit cross-frames in a web-plumb, no load condition, but the cross-frames are detailed to connect girder in a web-plumb position after load application, an inconsistency develops. In some cases, the inconsistent detailing of cross-frame members can lead to extreme problems during construction of curved I-girder bridges.

NTIS

Bridges (Structures); Girders; Construction; Design Analysis; Loads (Forces)

20020070267 Argonne National Lab., IL USA

Structural Failure Probability Analysis of Pipe Impact onto a Concrete Wall

Petkevicius, K.; Kulak, R. F.; Marchertas, P.; 2002; 12p; In English

Report No.(s): DE2002-795028; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of this study was to perform a probabilistic safety assessment of a steel pipe impacting against a concrete wall. The probabilistic structural integrity evaluation was coupled with a deterministic FE program, NEPTUNE. This evaluation included deterministic modeling, definition of random variables, description of failure criterion or limit state function, running the probabilistic analysis and reviewing the final results.

NTIS

Nuclear Reactors; Concretes

20020070654 NASA Glenn Research Center, Cleveland, OH USA

Slow Crack Growth of Brittle Materials With Exponential Crack-Velocity Formulation, Part 2, Constant Stress Rate Experiments

Choi, Sung R., Ohio Aerospace Inst., USA; Nemeth, Noel N., NASA Glenn Research Center, USA; Gyekenyesi, John P., NASA Glenn Research Center, USA; June 2002; 25p; In English

Contract(s)/Grant(s): RTOP 708-31-13

Report No.(s): NASA/TM-2002-211153/PT2; NAS 1.15:211153/PT2; E-13009-2/PT2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The previously determined life prediction analysis based on an exponential crack-velocity formulation was examined using a variety of experimental data on glass and advanced structural ceramics in constant stress rate and preload testing at ambient and elevated temperatures. The data fit to the relation of strength versus the log of the stress rate was very reasonable for most of the materials. Also, the preloading technique was determined equally applicable to the case of slow-crack-growth (SCG) parameter n greater than 30 for both the power-law and exponential formulations. The major limitation in the exponential crack-velocity formulation, however, was that the inert strength of a material must be known a priori to evaluate the important SCG parameter n , a significant drawback as compared with the conventional power-law crack-velocity formulation.

Author

Crack Propagation; Brittle Materials; Mechanical Properties

GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.

20020068710 NASA Ames Research Center, Moffett Field, CA USA

Grids for Dummies: Featuring Earth Science Data Mining Application

Hinke, Thomas H., NASA Ames Research Center, USA; Apr. 15, 2002; 44p; In English; EO Grid Workshop, 6-7 May 2002, Frascati, Italy; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation discusses the concept and advantages of linking computers together into data grids, an emerging technology for managing information across institutions, and potential users of data grids. The logistics of access to a grid, including the use of the World Wide Web to access grids, and security concerns are also discussed. The potential usefulness of data grids to the earth science community is also discussed, as well as the Global Grid Forum, and other efforts to establish standards for data grids.

CASI

Architecture (Computers); Wide Area Networks; Data Mining; Information Resources Management

20020069096 Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

Microearthquake Study of the Salton Sea Geothermal Field, California: Evidence of Stress Triggering

Holland, A. A.; February 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794327; INEEL/EXT-02-00191; No Copyright; Avail: National Technical Information Service (NTIS)

A digital network of 24 seismograph stations was operated from September 15, 1987 to September 30, 1988, by Lawrence Livermore National Labs and Unocal as part of the Salton Sea Scientific Drilling Project to study seismicity related to tectonics and geothermal activity near the drilling site. More than 200 microearthquakes were relocated in this study in order to image any pervasive structures that may exist within the Salton Sea geothermal field. First, detailed velocity models were obtained through standard 1-D inversion techniques. These velocity models were then used to relocate events using both single event methods and Double-Differencing, a joint hypocenter location method. An anisotropic velocity model was built from anisotropy estimates obtained from well logs within the study area. During the study period, the Superstition Hills sequence occurred with two moderate earthquakes of MS 6.2 and MS 6.6. These moderate earthquakes caused a rotation of the stress field as observed from the inversion of first motion data from microearthquakes at the Salton Sea geothermal field. Coulomb failure analysis also indicates that microearthquakes occurring after the Superstition Hills sequence are located within a region of stress increase suggesting stress triggering caused by the moderate earthquakes.

NTIS

Stresses; Earthquakes; Failure Analysis; Stress Distribution; Geothermal Technology

20020069110 Geological Survey, Augusta, ME USA

Snowpack in Maine: Maximum Observed and March 1 Mean Equivalent Water Content

Loiselle, M. C.; Hodgkin, G. A.; 2002; 30p; In English

Report No.(s): PB2002-108147; USGS/WRI-01-4258; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Historical snow data have been analyzed using geographic information systems software to determine the magnitude and distribution of maximum observed equivalent water content of snowpack for the State of Maine. Data from 109 sites with an average of 43 years of record were used to generate the map of maximum observed equivalent water content. Maximum observed water content ranged from less than 8 inches in south-coastal Maine to more than 20 inches in the northwestern mountains. A map of mean equivalent water content in snowpack on or about March 1 also was prepared with data from these sites. The March 1 mean equivalent water content ranged from less than 4 inches near the coast to more than 9 inches in northern Maine.

NTIS

Snow Cover; Geographic Information Systems

20020070206 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Fiber Optic/Cone Penetrometer System for Subsurface Heavy Metals Detection. Subsurface Contaminants Focus Area and Industry Programs

Mar. 2000; In English

Report No.(s): DE2002-768044; DOE/EM-0508; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this project is to develop an integrated fiber optic sensor/cone penetrometer system to analyze the heavy-metals content of the subsurface. This site characterization tool will use the penetrometer to deploy an optical fiber chemical sensor which is based on laser induced breakdown spectroscopy (LIBS). In LIBS, a pulse from a high-energy laser, typically a Nd:YAG operating at 1.06 m, is delivered to the soil sample via an optical fiber. The soil sample will absorb the laser pulse, heat rapidly, reduce to elemental form, and become electronically excited. When the input pulse is removed, the excited electrons drop to lower energy levels with the emission of characteristic photons. The plasma emission is returned from the sample via a second fiber. Elemental analysis is conducted by observation of the wavelength and intensities of the emission lines, which will depend upon the type and amount of material present within the plasma. This technique has shown to be an effective method for the quantitative analysis of contaminants in soils. There are several significant challenges associated with the integration of the LIBS sensor and cone penetrometer. One challenge is to design an effective means of optically accessing the soil via the fiber probe in the penetrometer. A second challenge is to develop the fiber probe system such that the resultant emission signal is adequate for quantitative analysis. These issues will be addressed during this project by investigating both hardware and software solutions.

NTIS

Optical Fibers; Heavy Metals; Emission Spectra; Laser-Induced Breakdown Spectroscopy; Quantitative Analysis

20020070210 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Passive Reactive Barrier: Subsurface Contaminants Focus Area

Mar. 2002; 42p; In English

Report No.(s): DE2002-794981; DOE/EM-0623; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Passive reactive barriers are in situ water permeable barriers that possess properties that either alter or destroy contaminants of concern (COC's) in place (e.g. certain VOCs) or bind the COC (e.g. uranium) to the barrier material. The prime purpose of this technology is to change the remediation strategy from pumping (i.e. advection of ground water) to passive capture under natural gradients. Advective pumping can only remove the dissolved phase of contaminant. Diffusion from sorbed phases on soil particles will later dissolve and increase the time required for pumping. Hence, passive reactive barriers are a less energy-intensive approach to aquifer cleanup, without the hydrologic impacts of continued pumping. Depending on site conditions, the barrier media may be designed for continued (non-regenerated) use, or may be placed in a manner that permits retrieval for extraction of bound contaminants and regeneration and replacement of the media. Appropriate down-gradient blocks will alert operators when barrier replacement is required.

NTIS

Advection; Aquifers

20020070217 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Electrical Resistance Tomography for Subsurface Imaging: Characterization, Monitoring, and Sensor Technology Crosscutting Program and Subsurface Contaminants Focus Area

Jun. 2000; 38p; In English

Report No.(s): DE2002-768919; DOE/EM-0538; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Electrical Resistance Tomography (ERT) noninvasively maps the 3-D resistivity field in the subsurface. It can be used on a scale from feet to kilometers. The 3-D resistivity field can be used to infer subsurface hydrogeological features and provides good resolution mapping of confining layers of various types. ERT imaging has been used for real-time monitoring and process control of remediation processes such as soil heating, pump and treat, steam injection, electrokinetics, Dynamic Underground Stripping (TechID 7), Hydrous Pyrolysis/Oxidation (TechID 1519) and more. ERT can be deployed via rapid and inexpensive installation of electrodes using a Cone Penetrometer (TechID 243). Additional applications are described under TechID 140 (Tanks) and TechID 2120 (Injected Subsurface Barriers); see also the related technology TechID 2121 (EIT).

NTIS

Tomography; Electrical Resistance; Electrical Resistivity

20020070264 Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

Results of 2001 Groundwater Sampling in Support of Conditional No Longer Contained-In Determination for the Snake River Plain Aquifer in the Vicinity of the Idaho Nuclear Technology and Engineering Center

Meachum, T. R.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795181; INEEL/EXT-02-00557; No Copyright; Avail: National Technical Information Service (NTIS)

The report summarizes the results of sampling five groundwater monitoring wells in the vicinity of the Idaho Nuclear Technology and Engineering Center at the Idaho National Engineering and Environmental Laboratory in 2001. Information on

general sampling practices, quality assurance practices, parameter concentrations, representativeness of sampling results, and cumulative cancer risk are presented. The information is provided to support a conditional No Longer Contained-In Determination for the Snake River Plain Aquifer in the vicinity of the Idaho Nuclear Technology and Engineering Center.

NTIS

Water Sampling; Reactor Technology; Ground Water

20020070266 Department of Energy, National Petroleum Technology Office, Tulsa, OK USA

Restored Drill Cuttings for Wetland Creation: Results of a Mesocosm Approach to Emulate Field Conditions under Varying Salinity and Hydrologic Conditions Final Report, 21 Jan. 1997 - 26 Jan. 2000

Hester, M. W.; Shaffer, G. P.; Wills, J. M.; DesRoches, D. J.; Jun. 2002; 102p; In English

Report No.(s): DE2002-795077; DOE/BC/14849-6; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Both interstitial water and plant tissue associated with the DC-A substrate exhibited low metal concentrations. Also in agreement with the previous study, plant performance in the DC-A substrate was found to be comparable to plant performance in the dredge spoil and topsoil substrates. This was extremely important because it indicated that the drill cuttings themselves served as an excellent substrate for wetland plant growth, but that the processing and stabilization techniques and drilling fluid formulations required further refinement.

NTIS

Wetlands; Sediments; Drilling

20020070292 NASA Goddard Space Flight Center, Greenbelt, MD USA

Global Change Data Center: Mission, Organization, Major Activities, and 2001 Highlights Annual Report, 2001

January 2002; 50p; In English; Original contains color illustrations

Report No.(s): NASA/NP-2002-2-428-GSFC; NAS 1.83:2-428-GSFC; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rapid efficient access to Earth sciences data is fundamental to the Nation's efforts to understand the effects of global environmental changes and their implications for public policy. It becomes a bigger challenge in the future when data volumes increase further and missions with constellations of satellites start to appear. Demands on data storage, data access, network throughput, processing power, and database and information management are increased by orders of magnitude, while budgets remain constant and even shrink. The Global Change Data Center's (GCDC) mission is to provide systems, data products, and information management services to maximize the availability and utility of NASA's Earth science data. The specific objectives are (1) support Earth science missions by developing and operating systems to generate, archive, and distribute data products and information; (2) develop innovative information systems for processing, archiving, accessing, visualizing, and communicating Earth science data; and (3) develop value-added products and services to promote broader utilization of NASA Earth Sciences Enterprise (ESE) data and information. The ultimate product of GCDC activities is access to data and information to support research, education, and public policy.

Author

Earth Sciences; Data Management; Information Systems

20020070355 Argonne National Lab., Environmental Research Div., IL USA

Origin and Recharge Rates of Alluvial Ground Waters, Eastern Desert, Egypt

Sultan, M.; Gheith, H.; Sturchio, N. C.; Alfy, Z. E.; Danishwar, S.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-42611; No Copyright; Avail: National Technical Information Service (NTIS)

Stable isotope and tritium analyses of shallow ground waters in the Eastern Desert of Egypt showed that the waters were derived largely by evaporation of regional precipitation and at least partly from precipitation in the past 45 y. to estimate the ground water recharge rate, we developed an integrated hydrologic model based on satellite data, geologic maps, infiltration parameters, and spatial rainfall distribution. Modeling indicated that during a severe 1994 storm, recharge through transmission loss in Wadi El-Tarfa was 21% of the precipitation volume. From archival precipitation data, we estimate that the annual recharge rate for the El-Tarfa alluvial aquifer is 4.7×10^6 m (sup 3). Implications for the use of renewable ground waters in arid areas of Egypt and in neighboring countries are clear.

NTIS

Aquifers; Deserts; Ground Water; Hydrology Models; Spatial Distribution

20020070371 Geological Survey, Water Resources Div., Denver, CO USA

Age Constraints on Fluid Inclusions in Calcite at Yucca Mountain

Neymark, L. A.; Amelin, Y. V.; Paces, J. B.; Peterman, Z. E.; Whelan, J. F.; 2002; 10p; In English

Report No.(s): DE2002-794113; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The (sup 207)Pb/(sup 235)U ages for 14 subsamples of opal or chalcedony layers younger than calcite formed at elevated temperature range between 1.88 (+-) 0.05 and 9.7 (+-) 1.5 Ma with most values older than 6-8 Ma. These data indicate that fluids with elevated temperatures have not been present in the unsaturated zone at Yucca Mountain since about 1.9 Ma and most likely since 6-8 Ma. Discordant U-Pb isotope data for chalcedony subsamples representing the massive silica stage in the formation of the coatings are interpreted using a model of the diffusive loss of U decay products. The model gives an age estimate for the time of chalcedony formation around 10-11 Ma, which overlaps ages of clay minerals formed in tuffs below the water table at Yucca Mountain during the Timber Mountain thermal event.

NTIS

Calcite; Clays; Silicon Dioxide

20020070527 Geological Survey, Water Resources Div., Denver, CO USA

Strontium Isotope Evolution of Pore Water and Calcite in the Topopah Spring Tuff, Yucca Mountain, Nevada

Marshall, B. D.; Futa, K.; 2002; 10p; In English

Report No.(s): DE2002-794109; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Pore water in the Topopah Spring Tuff has a narrow range of (delta)(sup 87)SR values that can be calculated from the (delta)(sup 87)SR values of the rock considering advection through and reaction with the overlying nonwelded tuffs of the PTn. This model can be extended to estimate the variation of (delta)(sup 87)SR in the pore water through time; this approximates the variation of (delta)(sup 87)SR measured in calcite fracture coatings. In samples of calcite where no silica can be dated by other methods, strontium isotope data may be the only method to determine ages. In addition, other SR-bearing minerals in the calcite and opal coatings, such as fluorite, may be dated using the same model.

NTIS

Strontium Isotopes; Calcite; Igneous Rocks; Petrology

20020070578 Geological Survey, Denver, CO USA

Pore-Water Isotopic Compositions and Unsaturated-Zone Flow, Yucca Mountain, Nevada

Yang, I. C.; 2002; 12p; In English

Report No.(s): DE2002-794111; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Isotopic compositions of core-water samples from boreholes USW SD-6 and USW WT-24 indicate that recent water has been introduced at depth. Tritium, carbon, oxygen, and deuterium isotopic compositions all support younger water at depth in the two boreholes. Peaks in tritium concentrations in pore-water samples, indicating younger water than the other samples, observed near the basal vitrophyre of the Topopah Spring Tuff and at the bottom of the CHF and the top of the PP in both boreholes SD-6 and WT-24. Larger (sup 14)C activities in two pore-water samples from WT-24 at the bottom of the CHF and the top of the PP indicate younger water than in other samples from WT-24. More positive (delta)(sup 18)O and (delta)D values indicate younger water in samples of pore water at the bottom of the CHF in boreholes SD-6 and WT-24. The isotopic compositions indicating younger water at depth in boreholes SD-6 and WT-24 occur at the basal vitrophyre zone of the Topopah Spring Tuff and the bottom of the CHF/upper part of the PP, probably from lateral preferential flow through connected fractures (fast-flow paths). The source of the young water at borehole WT-24 probably was recharge from The Prow to the north, which then flowed laterally southward through the highly fractured TSw. The source of the young water at borehole SD-6 probably was water flow from the Solitario Canyon fault to the west, which then flowed laterally through the TSw and CHF.

NTIS

Boreholes; Core Sampling; Water Flow; Ground Water

20020070579 Geological Survey, Water Resources Div., Denver, CO USA

Use of Thermal Data to Estimate Infiltration, Yucca Mountain, Nevada

LeCain, G. D.; Kurzmack, M.; 2002; 10p; In English

Report No.(s): DE2002-794108; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Temperature and pressure monitoring in a vertical borehole in Pagany Wash, Yucca Mountain, Nevada, measured disruptions of the natural gradients associated with the February, 1998, El Nino precipitation events. The temperature and pressure disruptions

indicated infiltration and percolation through the 12.1 m of Pagany Wash alluvium and deep percolation to greater than 35.2 m into the Yucca Mountain Tuff.

NTIS

Boreholes; Igneous Rocks; Petrology; Radioactive Wastes

20020070580 Geological Survey, Denver, CO USA

Evidence for an Unsaturated-Zone Origin of Secondary Minerals in Yucca Mountain, Nevada

Whelan, J. F.; Roedder, E.; Paces, J. B.; 2002; 14p; In English

Report No.(s): DE2002-794106; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The unsaturated zone (UZ) in Miocene-age welded tuffs at Yucca Mountain, Nevada, is under consideration as a potential site for the construction of a high-level radioactive waste repository. Secondary calcite and silica minerals deposited on fractures and in cavities in the UZ tuffs are texturally, isotopically, and geochemically consistent with UZ deposition from meteoric water infiltrating at the surface and percolating through the UZ along fractures. Nonetheless, two-phase fluid inclusions with small and consistent vapor to liquid (V:L) ratios that yield consistent temperatures within samples and which range from about 35 to about 80 C between samples have led some to attribute these deposits to formation from upwelling hydrothermal waters. Geochronologic studies have shown that calcite and silica minerals began forming at least 10 Ma and continued to form into the Holocene. If their deposition were really from upwelling water flooding the UZ, it would draw into question the suitability of the site as a waste repository.

NTIS

Fractures (Materials); Minerals; Radioactive Wastes

20020070581 Geological Survey, Water Resources Div., Denver, CO USA

Geochemical Homogeneity of Tuffs at the Potential Repository Level, Yucca Mountain, Nevada

Peterman, Z. E.; Cloke, P.; 2002; 10p; In English

Report No.(s): DE2002-794103; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In a potential high-level radioactive waste repository at Yucca Mountain, Nevada, radioactive waste and canisters, drip shields protecting the waste from seepage and from rock falls, the backfill and invert material of crushed rock, the host rock, and water and gases contained within pores and fractures in the host rock together would form a complex system commonly referred to as the near-field geochemical environment. Materials introduced into the rock mass with the waste that are designed to prolong containment collectively are referred to as the Engineered Barrier System, and the host rock and its contained water and gases compose the natural system. The interaction of these component parts under highly perturbed conditions including temperatures well above natural ambient temperatures will need to be understood to assess the performance of the potential repository for long-term containment of nuclear waste. The geochemistry and mineralogy of the rock mass hosting the emplacement drifts must be known in order to assess the role of the natural system in the near-field environment. Emplacement drifts in a potential repository at Yucca Mountain would be constructed in the phenocryst-poor member of the Topopah Spring Tuff which is composed of both lithophysal and nonlithophysal zones. The chemical composition of the phenocryst-poor member has been characterized by numerous chemical analyses of outcrop samples and of core samples obtained by surface-based drilling. Those analyses have shown that the phenocryst-poor member of the Topopah Spring Tuff is remarkably uniform in composition both vertically and laterally. To verify this geochemical uniformity and to provide rock analyses of samples obtained directly from the potential repository block, major and trace elements were analyzed in core samples obtained from drill holes in the cross drift, which was driven to provide direct access to the rock mass where emplacement drifts would be constructed.

NTIS

Radioactive Wastes; Geochemistry; Complex Systems

20020070592 Desert Research Inst., Reno, NV USA

Assessing Groundwater Model Uncertainty for the Central Nevada Test Area

Pohll, G.; Pohlmann, K.; Hassan, A.; Chapman, J.; Mihev, T.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795454; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this study is to quantify the flow and transport model uncertainty for the Central Nevada Test Area (CNTA). Six parameters were identified as uncertain, including the specified head boundary conditions used in the flow model, the spatial distribution of the underlying welded tuff unit, effective porosity, sorption coefficients, matrix diffusion coefficient, and the geochemical release function which describes nuclear glass dissolution. The parameter uncertainty was described by assigning prior statistical distributions for each of these parameters. Standard Monte Carlo techniques were used to sample from the

parameter distributions to determine the full prediction uncertainty. Additional analysis is performed to determine the most cost-beneficial characterization activities. The maximum radius of the tritium and strontium-90 contaminant boundary was used as the output metric for evaluation of prediction uncertainty. The results indicate that combining all of the uncertainty in the parameters listed above propagates to a prediction uncertainty in the maximum radius of the contaminant boundary of 234 to 308 m and 234 to 302 m, for tritium and strontium-90, respectively. Although the uncertainty in the input parameters is large, the prediction uncertainty in the contaminant boundary is relatively small. The relatively small prediction uncertainty is primarily due to the small transport velocities such that large changes in the uncertain input parameters causes small changes in the contaminant boundary. This suggests that the model is suitable in terms of predictive capability for the contaminant boundary delineation.

NTIS

Ground Water; Boundary Conditions; Porosity

20020070670 Geological Survey, Water Resources Div., Pembroke, NH USA

Water Resources Data for New Hampshire and Vermont, Water Year 2001 *Annual Report, 1 Oct. 2000 - 30 Sep. 2001*

Coakley, M. F.; Ward, S. L.; Hilgendorf, G. S.; Kiah, R. G.; Apr. 2002; 218p; In English

Report No.(s): PB2002-107282; USGS/WDR/NH/VT-01-1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Water-resources data for the 2001 water year for New Hampshire and Vermont consists of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 75 gaging stations, stage records for 5 lakes, month end contents for 2 lakes and reservoirs, water levels for 38 observation wells. Also included are data for 43 crest-stage partial-record stations. Additional water data were collected at various sites, which are not part of the systematic data-collection program and are published as miscellaneous measurements or under Supplemental National Water-Quality Assessment Data for Gaging Stations in New Hampshire and Vermont. A few pertinent stations in bordering states are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Hampshire and Vermont.

NTIS

Water Resources; New Hampshire; Geological Surveys; Data Systems

43

EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see 35 Instrumentation and Photography.

20020067746 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Overview of the Earth Observing System MODIS Instrument and Associated Data Systems Performance

Salomonson, Vincent V., NASA Goddard Space Flight Center, USA; Barnes, William, NASA Goddard Space Flight Center, USA; Xiong, Jack, NASA Goddard Space Flight Center, USA; Kempler, Steve, NASA Goddard Space Flight Center, USA; Masuoka, Ed, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Invited Talk at Los Alamos National Laboratory, 14 May 2002, Los Alamos, NM, USA; Sponsored by Los Alamos National Lab., USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra Mission began to produce data in February 2000. Now a little over 2 years from that time, the instrument continues to produce good data and products for land, oceans, and atmospheres studies are reaching or achieved maturity for science and applications studies. All subsystems of the instrument are performing as expected: the signal-to-noise (S/N) performance meets or exceeds specifications, band-to-band registration meets specifications, geodetic registration of observations is nearing 50 meters (one sigma) and the spectral bands are located where they were intended to be pre-launch and attendant gains and offsets are stable to date. Some problems with electronic noise, optical leaks, etc. have been identified and solutions to compensate or eliminate these effects have been successful. The data systems have produced a complete year or more for all data products extending from November 2000. Efforts are underway to provide data sets for the greater Earth science community and to improve access to these products at the various Distributed Active Archive Centers (DAAC's). The MODIS instrument on the EOS Aqua mission should also be expected to be in orbit and functioning in the Spring of 2002.

Author

Data Systems; Earth Observing System (EOS); Imaging Spectrometers; Spectroradiometers; Performance Tests

20020067748 NASA Ames Research Center, Moffett Field, CA USA

Demonstrating Acquisition of Real-Time Thermal Data Over Fires Utilizing UAVs

Ambrosia, Vincent G., NASA Ames Research Center, USA; Wegener, Steven S., NASA Ames Research Center, USA; Brass, James A., NASA Ames Research Center, USA; Buechel, Sally W., Terra-Mar Resource Information Services, USA; Apr. 17, 2002; 12p; In English; Ninth Biennial Forest Service Remote Sensing Applications Conference, 8-12 Apr. 2002, San Diego, CA, USA; Sponsored by Forest Service, USA

Contract(s)/Grant(s): RTOP 710-00-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A disaster mitigation demonstration, designed to integrate remote-piloted aerial platforms, a thermal infrared imaging payload, over-the-horizon (OTH) data telemetry and advanced image geo-rectification technologies was initiated in 2001. Project FIRE incorporates the use of a remotely piloted Uninhabited Aerial Vehicle (UAV), thermal imagery, and over-the-horizon satellite data telemetry to provide geo-corrected data over a controlled burn, to a fire management community in near real-time. The experiment demonstrated the use of a thermal multi-spectral scanner, integrated on a large payload capacity UAV, distributing data over-the-horizon via satellite communication telemetry equipment, and precision geo-rectification of the resultant data on the ground for data distribution to the Internet. The use of the UAV allowed remote-piloted flight (thereby reducing the potential for loss of human life during hazardous missions), and the ability to "finger and stare" over the fire for extended periods of time (beyond the capabilities of human-pilot endurance). Improved bit-rate capacity telemetry capabilities increased the amount, structure, and information content of the image data relayed to the ground. The integration of precision navigation instrumentation allowed improved accuracies in geo-rectification of the resultant imagery, easing data ingestion and overlay in a GIS framework. We focus on these technological advances and demonstrate how these emerging technologies can be readily integrated to support disaster mitigation and monitoring strategies regionally and nationally.

Author

Data Acquisition; Real Time Operation; Pilotless Aircraft; Forest Fires; Infrared Imagery; Satellite Communication; Data Transmission

20020068906 BAE Systems, Rome, NY USA

Pinpoint Phase 1 Final Report, Sep. 2000-Jan. 2002

Clark, C. R.; Shanafelt, R. E.; May 2002; 72p; In English; Original contains color images; Prepared in collaboration with Radix Technologies, Inc., Mountain View, CA

Contract(s)/Grant(s): F30602-99-D-0152; AF Proj. 1027

Report No.(s): AD-A403893; AFRL-IF-RS-TR-2002-93; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of the Pin Point program is to integrate adaptive beam forming techniques for co-channel interference cancellation, with Time Difference of Arrival - Differential Doppler (TDOA-DD) processing for rapid and precise Geolocation of tactical emitters in a dense co-channel signal and interference environment. The PinPoint program is intended to complement the existing CHAALS (Communication High Accuracy Airborne Location System) system by providing advanced techniques that address the Army's longer-term Objective System requirements. The end goal of the PinPoint multi-phase program is to integrate Pin Point precision geolocation capability with a co-channel signal intercept system employing multiple multi-antenna airborne collection platforms, such as ACS (Aerial Common Sensor), to provide a complete, precise and real-time geographical image of the modern battlefield signals environment. The co-channel interference look-through capability provided by Pin Point and related co-channel detect, DF (direction finding), and beamforming copy front-end assets will enable the battlefield environment to be accurately monitored deep behind the forward troops from airborne platforms positioned at safe standoff distances.

DTIC

Geographic Information Systems; Doppler Radar; Mapping; Beamforming

20020069116 Miami Univ., Dept. of Physics, Coral Gables, FL USA

Ocean Observations with EOS/MODIS: Algorithm Development and Post Launch Studies Semiannual Report, Jan. - Jun. 1999

Gordon, Howard R., Miami Univ., USA; Jul. 15, 1999; 30p; In English

Contract(s)/Grant(s): NAS5-31363; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This separation has been logical thus far; however, as launch of AM-1 approaches, it must be recognized that many of these activities will shift emphasis from algorithm development to validation. For example, the second, third, and fifth bullets will become almost totally validation-focussed activities in the post-launch era, providing the core of our experimental validation effort. Work under the first bullet will continue into the post-launch time frame, driven in part by algorithm deficiencies revealed

as a result of validation activities. Prior to the start of the 1999 fiscal year (FY99) we were requested to prepare a brief plan for our FY99 activities. This plan is included as Appendix 1. The present report describes the progress made on our planned activities.

Author

Algorithms; Atmospheric Correction; Radiation Distribution; Water

20020070202 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Overview of the Earth Observing System MODIS Instrument Performance, Data Systems Performance, and Data Products Status and Availability

Salomonson, Vincent V., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; TeraScan Conference, 19-21 Mar. 2002, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra Mission began to produce data in February 2000. Now, approximately 2 years from that time, the instrument is operating well. All subsystems of the instrument are performing as expected, the signal-to-noise (S/N) performance meets or exceeds specifications, band-to-band registration meets specifications, geodetic registration of observations is nearing 50 meters (one sigma) and the spectral bands are located where they were intended to be pre-launch and attendant gains and offsets are stable to date. The data systems have performed well and are producing a wide variety of data products useful for scientific and applications studies in relatively consistent fashion extending from November 2000 to the present. Within the approximately 40 MODIS data products, several are new and represent powerful and exciting capabilities. The remainder of the MODIS products exceed or, at a minimum, match the capabilities of products from heritage sensors such as, for example, the Advanced Very High Resolution Radiometer (AVHRR). Efforts are underway to provide data sets for the greater Earth science community and to improve access to these products at the various Distributed Active Archive Centers (DAAC's) or through Direct Broadcast (DB) stations. The MODIS instrument on the EOS Aqua mission should also be expected to be in orbit and functioning in the Spring of 2002.

Author

Earth Observing System (EOS); Imaging Spectrometers; Imaging Techniques; Spectroradiometers; Advanced Very High Resolution Radiometer; Data Acquisition

20020070218 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Topographical Mapping System. Tanks Focus Area

Sep. 1999; In English

Report No.(s): DE2002-767452; DOE/EM-0478; No Copyright; Avail: National Technical Information Service (NTIS)

Radioactive waste storage tanks in use at many of the U.S. Department of Energy (DOE) sites are beyond the intended design life. The waste in these tanks must be remediated and the tanks closed. Before these activities are performed, the physical condition of tank interiors must be determined along with detailed information regarding any obstructions and potential problems that may be encountered during installation of retrieval systems. This task is difficult because the tanks are underground and have limited access. The only way to see the physical contents of the tank is to install tools through the tank's openings, or risers. The Topographical Mapping System (TMS), a three-dimensional (3-D) mapping system that can safely operate in hazardous and radiological environments, has been developed to meet this need. This system provides an accurate 3-D view of the tank interior and gathers data on volume and contents inside storage tanks.

NTIS

Mapping; Dimensional Analysis

20020070263 National Consortium Remote Sensing in Transportation, USA

Remote Sensing and Spatial Information Technologies in Transportation, Synthesis Report 2001

2002; 30p; In English

Report No.(s): PB2002-107820; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Four university consortia are pursuing research in applications of remote sensing and spatial information technologies in four focus areas of transportation: (1) environmental assessment, (2) infrastructure management, (3) traffic flow and (4) hazards, safety and disaster assessment. A number of Technology Application Partners, mostly commercial firms, are engaged in a parallel effort to develop recent research into marketable products. This Synthesis Report from the university consortia marks the end of the first year of the research program. It places the research in the context of the state of the practice as it currently exists. It is presented in three sections. The first is a quick overview of the technology. The second section documents examples of application of the

technology in DOTs in the U.S. over the last decade. This sets the stage for the third section, a summary of consortium research in its first year of operation.

NTIS

Remote Sensing; Technology Utilization; Environment Management; Transportation

20020070293 Colorado Univ., Dept. of Geological Sciences, Boulder, CO USA

Quantifying Fractional Ground Cover on the Climate Sensitive High Plains Using AVIRIS and LANDSAT TM Data

Warner, Amanda Susan, Colorado Univ., USA; [2002]; 86p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-6051; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The High Plains is an economically important and climatologically sensitive region of the USA and Canada. The High Plains contain 100,000 sq km of Holocene sand dunes and sand sheets that are currently stabilized by natural vegetation. Droughts and the larger threat of global warming are climate phenomena that could cause depletion of natural vegetation and make this region susceptible to sand dune reactivation. This thesis is part of a larger study that is assessing the effect of climate variability on the natural vegetation that covers the High Plains using LANDSAT 5 and LANDSAT 7 data. The question this thesis addresses is how can fractional vegetation cover be mapped with the LANDSAT instruments using linear spectral mixture analysis and to what accuracy. The method discussed in this thesis made use of a high spatial and spectral resolution sensor called AVIRIS (Airborne Visible and Infrared Imaging Spectrometer) and field measurements to test vegetation mapping in three LANDSAT 7 sub-scenes. Near-simultaneous AVIRIS images near Ft. Morgan, Colorado and near Logan, New Mexico were acquired on July 10, 1999 and September 30, 1999, respectively. The AVIRIS flights preceded LANDSAT 7 overpasses by approximately one hour. These data provided the opportunity to test spectral mixture algorithms with AVIRIS and to use these data to constrain the multispectral mixed pixels of LANDSAT 7. The comparisons of mixture analysis between the two instruments showed that AVIRIS endmembers can be used to unmix LANDSAT 7 data with good estimates of soil cover, and reasonable estimates of non-photosynthetic vegetation and green vegetation. LANDSAT 7 derived image endmembers correlate with AVIRIS fractions, but the error is relatively large and does not give a precise estimate of cover.

Author

Quantitative Analysis; Drought; Global Warming; Satellite Imagery; Soils; Vegetation; Thematic Mapping

20020070294 Colorado Univ., Dept. of Geological Sciences, USA

Mapping the Potential for Eolian Surface Activity in Grasslands of the High Plains using LANDSAT Images

Gutmann, Ethan Dain, Colorado Univ., USA; [2002]; 77p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-3437; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

There are over 100,000 square kilometers of eolian sand dunes and sand sheets in the High Plains of the central USA. These land-forms may be unstable and may reactivate again as a result of land-use, climate change, or natural climatic variability. The main goal of this thesis was to develop a model that could be used to map an estimate of future dune activity. Multi-temporal calibrated LANDSATs 5 Thematic Mapper (TM) and 7 Enhanced Thematic Mapper Plus (ETM+) NDVI imagery were used in conjunction with the CENTURY vegetation model to correlate vegetation cover to climatic variability. This allows the creation of a predicted vegetation map which, combined with current wind and soil data, was used to create a potential sand transport map for range land in the High Plains under drought conditions.

Derived from text

Climate Change; Grasslands; Imaging Spectrometers; Normalized Difference Vegetation Index; Thematic Mappers (LANDSAT)

20020070652 NASA Goddard Space Flight Center, Greenbelt, MD USA

MODIS Observations of Smoke and Fires

Kaufman, Yoram, NASA Goddard Space Flight Center, USA; Ichoku, Charles, Science Systems and Applications, Inc., USA; Remer, Lorraine, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The MODIS (Moderate Resolution Imaging Spectroradiometer) instruments collect daily measurements of our planet since early 2000 from the Terra spaceborne polar platform. It has unique channels to observe smoke over land and ocean and to observe fires. Using unsaturated channels at 3.9 micron MODIS detects the fires and estimates the fire radiative energy. Using solar channels in the visible (0.47 and 0.66 micron) and in the mid IR (2.1 micron) MODIS measures the smoke optical thickness distribution and evolution over the land. Seven Channels in the solar spectrum are used to detect the smoke properties and distribution over the oceans. Data from the Aerosol Robotic Network, are used to validate the MODIS observations. The MODIS aerosol data presented in a movie form is used to observe the generation of smoke plumes and their dispersion around the globe.

For example a key conclusion is that smoke in particular from Southern Africa can pollute significantly the 'pristine' Southern Hemisphere zonal range of 45°S-60°S, and the Northern Pacific.

Author

Fires; Smoke; Aerosols; Radiance; Optical Thickness; Solar Spectra

20020070666 Colorado Univ., Cooperative Inst. for Research in Environmental Science, Boulder, CO USA

Quantifying BRDF Effects in Comparing LANDSAT-7 and AVIRIS Near-Simultaneous Acquisitions for Studies of High Plains Vegetation Cover

Goetz, A. F. H., Colorado Univ., USA; Heidebrecht, K. B., Colorado Univ., USA; Gutmann, E. D., Colorado Univ., USA; Warner, A. S., Colorado Univ., USA; Johnson, E. L., Colorado Univ., USA; Lestak, L. R., Colorado Univ., USA; [1999]; 62p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-6051; NAG5-3437; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Approximately 100,000 sq. km of the High Plains of the central United States are covered by sand dunes and sand sheets deposited during the Holocene. Soil-dating evidence shows that there were at least four periods of dune reactivation during major droughts in the last 10,000 years. The dunes in this region are anchored by vegetation. We have undertaken a study of land-use change in the High Plains from 1985 to the present using LANDSAT 5 TM and LANDSAT 7 ETM+ images to map variation in vegetation cover during wet and dry years. Mapping vegetation cover of less than 20% is important in modeling potential surface reactivation since at this level the vegetation no longer sufficiently shields sandy surfaces from movement by wind. LANDSAT TM data have both the spatial resolution and temporal coverage to facilitate vegetation cover analysis for model development and verification. However, there is still the question of how accurate TM data are for the measurement of both growing and senescent vegetation in and semi-arid regions. AVIRIS provides both high spectral resolution as well as high signal-to-noise ratio and can be used to test the accuracy of LANDSAT TM and ETM+ data. We have analyzed data from AVIRIS flown nearly concurrently with a LANDSAT 7 overpass. The comparison between an AVIRIS image swath of 11 km width subtending a 30 deg. angle and the same area covered by a 0.8 deg. angle from LANDSAT required accounting for the BRDF. A normalization technique using the ratio of the reflectances from registered AVIRIS and LANDSAT data proved superior to the techniques of column averaging on AVIRIS data alone published previously by Kennedy et al. This technique can be applied to aircraft data covering a wider swath angle than AVIRIS to develop BRDF responses for a wide variety of surfaces more efficiently than from ground measurements.

Author

Quantitative Analysis; Vegetation; Time Measurement; Thematic Mapping; Satellite Imagery

44

ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

20020068069 Texas Univ., Dept. of Chemical Engineering, Austin, TX USA

Implantable Biofuel Cell Electrodes *Final Report, 1 Jan. 1999-31 Dec. 2001*

Heller, Adam; Jul. 05, 2002; 3p; In English

Contract(s)/Grant(s): N00014-97-1-1074

Report No.(s): AD-A403772; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of the project was the design of glucose electrooxidizing anodes and oxygen electroreducing cathodes for a miniature compartment-less and case-less biofuel cell powering sensor-transmitter and receiver-actuator systems implanted in animals. It resulted in the smallest (smaller by a factor of 180 than previously reported) and highest power density (higher by a factor of 5) biofuel cell ever built. The results were obtained in a pH 5 solution in absence of chloride at 37 deg C and formed the basis for their subsequent extension to physiological conditions after the project ended on Dec 1, 2001. The anodes were based on the electrical 'wiring' of glucose oxidase with redox polymers of low (reducing) redox potentials that connected their redox centers to carbon electrodes. The cathodes were based on the electrical 'wiring' of copper enzymes (laccases and bilirubin oxidases) with high (oxidizing) redox potential redox polymers to carbon cathodes. The anodic current densities near 0.1 V (Ag/AgCl) were of (circumflex) 1 mA/sq cm and the cathodic current densities were of (circumflex) 3 mA/sq cm at (circumflex)

0.5 V (Ag/AgCl). The smallest biofuel cell built consisted of two 7 micrometers diameter 2 cm long carbon fibers. It's output at 37 deg C was (circumflex) 1 Micro-W.

DTIC

Carbon; Electrodes; Electrochemistry; Implantation; Glucose; Electrochemical Synthesis

20020068960 National Renewable Energy Lab., Golden, CO USA

Remapping of the Wind Energy Resource in the Midwestern USA

Schwartz, M.; Elliott, D.; Dec. 2001; 14p; In English

Report No.(s): DE2002-31083; NREL/LAB-500-31083; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A recent increase in interest and development of wind energy in the Midwestern USA has focused the need for updating wind resource maps of this area. The wind resource assessment group at the National Renewable Energy Laboratory (NREL), a U.S. Department of Energy (DOE) laboratory, has produced updated high-resolution (1-km) wind resource maps for several states in this region. NREL used computerized wind resource mapping tools, including a comprehensive meteorological database and Geographic Information System (GIS) software, both developed over the past 5 years, to create updated wind resource maps of North Dakota, South Dakota, and Illinois. These states were chosen because DOE believed that creating updated wind resource maps to supersede those generated in the 1980s could accelerate wind energy development in these states.

NTIS

Windpower Utilization; Geographic Information Systems; Meteorological Services; Renewable Energy

20020069010 Colorado State Univ., Fort Collins, CO USA

Device Physics of Thin-Film Polycrystalline Cells and Modules. Subcontractor Report Final Report, Feb. 1998 - Aug. 01

Sites, J. R.; Jan. 2002; 60p; In English

Report No.(s): DE2002-31458; NREL/SR-520-31458; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Work has been performed at Colorado State University on basic measurements of CdTe and CuInGaS solar cells fabricated at a number of collaborating laboratories. The first area of emphasis has been to quantitatively deduce the loss mechanisms in these cells, and to make appropriate comparisons that illuminate where progress in being made. Cells evaluated include those at or near record efficiencies and those made with new processing strategies. A second area of emphasis, the role of impurities, has focused on sodium in CIS. Cells made with varying amounts of sodium added during CIS deposition were fabricated at NREL using four types of substrates. Best performance was achieved with 0.01 to 0.1 at.% sodium. The third area of study has been small-spot measurement of micro-nonuniformities. A new facility was built to focus a laser beam onto a solar cell with 1-micrometer beam size, 1-micrometer resolution and repeatability, and one-sun intensity. Specific projects to date have focused on CdTe and have included the local effect of CdCl_2 , local intermixing of sulfur, and the effect of temperature-induced stress.

NTIS

Thin Films; Solar Cells; Polycrystals

20020069011 Argonne National Lab., IL USA

Water Balance in Fuel Cells Systems

Kopasz, J. P.; Ahmed, S.; Kumar, R.; Krumpelt, M.; Mar. 2002; 12p; In English

Report No.(s): DE2002-41746; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fuel cell systems are attractive for their high efficiency (i.e., electric power generated per weight/volume of fuel,) and lower emissions. These systems are being developed for applications that include transportation (propulsion and auxiliary), remote stationary, and portable. Where these systems use on-board fuel processing of available fuels, the fuel processor requires high-purity water. For utility applications, this water may be available on-site, but for most applications, the process water must be recovered from the fuel cell system exhaust gas. For such applications, it is critically important that the fuel cell system be a net water-producing device. A variety of environmental conditions (e.g., ambient temperature, pressure), fuel cell system design, and operating conditions determine whether the fuel cell system is water-producing or water-consuming. This paper will review and discuss the conditions that determine the net-water balance of a generic fuel cell system and identify some options that will help meet the water needs of the fuel processor.

NTIS

Fuel Cells; Water Balance; Systems Engineering

20020069081 Gas-, Elektrizitäts- und Wasserwerke, Cologne, Germany

Digester Gas-Fuel Cell-Project Final Report

Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM Report No.(s): DE2002-794363; No Copyright; Avail: National Technical Information Service (NTIS)

GEW has been operating the first fuel cell in Europe producing heat and electricity from digester gas in an environmentally friendly way. The first 9,000 hours in operation were successfully concluded in August 2001. The fuel cell powered by digester gas was one of the 25 registered 'Worldwide projects' which NRW presented at the EXPO 2000. In addition to this, it is a key project of the NRW State Initiative on Future Energies. All of the activities planned for the first year of operation were successfully completed: installing and putting the plant into operation, the transition to permanent operation as well as extended monitoring till May 2001.

NTIS

Fuel Cells; Electricity

20020069095 North Carolina Agricultural and Technical State Univ., Dept. of Chemical Engineering, Greensboro, NC USA
Separation of Hydrogen and Carbon Dioxide Using a Novel Membrane Reactor in Advanced Fossil Energy Conversion Process Annual Report, 1 Sep. 1999 - 31 Aug. 00

Shamsuddin, I.; Jun. 25, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794127; No Copyright; Avail: National Technical Information Service (NTIS)

Inorganic membrane reactors offer the possibility of combining reaction and separation in a single operation at high temperatures to overcome the equilibrium limitations experienced in conventional reactor configurations. Such attractive features can be advantageously utilized in a number of potential commercial opportunities, which include dehydrogenation, hydrogenation, oxidative dehydrogenation, oxidation and catalytic decomposition reactions. However, to be cost effective, significant technological advances and improvements will be required to solve several key issues which include: (1) perm-selective thin solid film, (2) thermal, chemical and mechanical stability of the film at high temperatures, and (3) reactor engineering and module development in relation to the development of effective seals at high temperature and high pressure. In this project, we are working on the development and application of palladium and palladium-silver alloy thin-film composite membranes in membrane reactor-separator configuration for simultaneous production and separation of hydrogen and carbon dioxide at high temperature. From our research on Pd-composite membrane, we have demonstrated that the new membrane has significantly higher hydrogen flux with very high perm-selectivity than any of the membranes commercially available. The steam reforming of methane by equilibrium shift in Pd-composite membrane reactor is being studied to demonstrate the potential application this new development. To have better understanding of the membrane reactor, during this reporting period, we developed a two-dimensional pseudo-homogeneous reactor model for steam reforming of methane by equilibrium shift in a tubular membrane reactor. In numerical solution of the reactor model equations, numerical difficulties were encountered and we seeking alternative solution techniques to overcome the problem.

NTIS

Carbon Dioxide; Methane; Palladium Alloys

20020069106 Clean Air Vehicle Technology Center, Research Triangle Park, NC USA

Characterization of Emissions from Malfunctioning Vehicles Fueled with Oxygenated Gasoline-Ethanol (E-10) Fuel. Part 2

Loomis, C.; Pack, C.; Jan. 2002; 42p; In English; Sponsored by Environmental Protection Agency, Research Triangle Park, NC. National Exposure Research Lab

Report No.(s): PB2002-107676; EPA/600/R-01/053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 1993 Ford Taurus and a 1995 Chevrolet Achieva were tested using three different fuels: (1) a winter grade (E-10) fuel containing 10% (vol.) 200 proof ethanol, (2) a winter grade (WG) fuel without any oxygen containing compounds, and (3) a summer grade (SG) fuel without oxygenates. Vehicle emissions were characterized at test temperatures of 75 (SG fuel only), 20, 0, and -20 deg F. The vehicles were tested under two simulated malfunction modes: (1) the oxygen (O₂ mode) sensor was disconnected and (2) the exhaust gas recirculating valve (EGR mode) was disconnected and plugged. The malfunction modes were not tested simultaneously. The vehicles were tested on the Urban Dynamometer Driving Schedule (UDDS) of the Federal Test Procedure (FTP). Four IM240 test cycles were run after each of the UDDS tests and the exhaust particulate matter (PM_{2.5} and PM₁₀), from the four IM240 driving cycles were collected on single filters. The gaseous emissions were collected and analyzed for total hydrocarbons, carbon monoxide, oxides of nitrogen speciated (individual) hydrocarbons, speciated (individual) aldehydes, ethanol, methanol, 2-propanol, methyltertiarybutyl (MTBE) ether, and ethyltertiarybutyl (ETBE) ether. Hydrocarbon

emissions generally increased as test temperature decreased for both vehicles, fuels, and test modes. The E-10 fuel reduced some emissions and increased others, while disconnecting the O₂ sensor increased emissions over the other two modes. The trend for carbon monoxide and oxides of nitrogen emissions showed a general increase in emission rates as the testing temperature decreased. When the O₂ sensor was disabled, the trend showed the increasing carbon monoxide emissions and when the EGR valve was disabled it was observed that the oxides of nitrogen emissions generally increased.

NTIS

Combustion Products; Exhaust Emission; Exhaust Gases; Fuel Tests

20020069144 National Renewable Energy Lab., Golden, CO USA

PVMA_T Improvements in the BP Solar Photovoltaic Module Manufacturing Technology Final Report, 4 May 1998 - 30 Nov. 2001

Wohlgemuth, J.; Shea, S.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-32066; NREL/SR-520-32066; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this three year PVMA_T program was to continue the advancement of BP Solar PV manufacturing technologies in order to design and implement a process which produces polycrystalline silicon PV modules that can be sold profitably for \$2.00 per peak watt or less and which increases the production capacity of the Frederick plant to at least 25 megawatts per year. Achieving these major objectives was based on meeting the following specific task goals. Develop a process to produce silicon feedstock from Na₂SiF₆ that can be sold profitably for less than \$15/kilogram in large quantities. Demonstrate the process in a pilot facility. Optimize and improve control of the casting process to increase the process yield (kilograms of silicon out divided by kilograms of silicon in) by 7% and to improve material quality such that average cell efficiency increases by 4%. Reduce the center-to-center cut distance on the wire saw to less than 450 micrometers in production, and develop a wire saw process that reduces the consumable costs by at least \$0.05/wafer, that does not require organic cleaners nor result in generation of hazardous waste material. Develop, demonstrate and implement a cost-effective cell process that produces a minimum average cell efficiency of 15% and improves the cell line electrical yield by 5% when applied to BP Solar cast polycrystalline silicon wafers. Develop and qualify an encapsulation system that meets all technical and reliability requirements and can be laminated and cured in less than 6 minutes. Improve BP Solar's product and materials handling (including efforts in at least 3 separate areas) to increase line yield by 3% and reduce handling labor to save \$0.05/watt. Improve process measurement and control in the production line (including efforts in at least 3 separate areas) to improve yield by 3% and reduce rework by 50%.

NTIS

Photovoltaic Cells; Hazardous Wastes; Solar Cells

20020070213 Carnegie-Mellon Univ., Pittsburgh, PA USA

Atmospheric Aerosol Source-Receptor Relationships: The Role of Coal-Fired Power Plants Semiannual Report, 1 Aug. 2001 - 31 Jan. 2002

Robinson, A. L.; Pandis, S. N.; Davidson, C. I.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794361; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the technical progress made on the Pittsburgh Air Quality Study during the period of February through July of 2001. The major effort during this period involved the set-up and initiation of the ambient monitoring campaign. The central sampling station next to the Carnegie Mellon University in Schenley Park was completed. Baseline measurements began on June 1, 2001, and the first intensive sampling period occurred between June 30, 2001 and August 3, 2001. Data were collected at both the central site and a set of satellite sites surrounding Pittsburgh.

NTIS

Air Quality; Aerosols; Combustion

20020070587 North Carolina Univ., Chapel Hill, NC USA

Search for the Factors Determining the Photodegradation in High Efficiency a-Si:H Solar Cells. Final Subcontractor Report, 28 January 1998-15 August 2001

Han, D.; Mar. 2002; 62p; In English

Report No.(s): DE2002-31754; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work is to develop improved understanding of the correlation between material properties and the amorphous silicon-based solar cell performance such as open circuit voltage, and the photodegradation. This correlation will be described

in terms of photoluminescence (PL), electroluminescence (EL) and Raman spectroscopies. The other objective of this work will verify the hydrogen microstructure by nuclear magnetic resonance (NMR) technique.

NTIS

Electroluminescence; Nuclear Magnetic Resonance; Photoluminescence; Solar Cells; Photodecomposition

20020070607 NASA Glenn Research Center, Cleveland, OH USA

Sensorless Control of Permanent Magnet Machine for NASA Flywheel Technology Development

Kenny, Barbara H., NASA Glenn Research Center, USA; Kascak, Peter E., Ohio Aerospace Inst., USA; July 2002; 12p; In English; 37th Intersociety Energy Conversion Engineering Conference, 28 Jul. - 2 Aug. 2002, Washington, DC, USA; Sponsored by Electron Devices Society, USA

Contract(s)/Grant(s): RTOP 755-1A-09

Report No.(s): NASA/TM-2002-211726; E-13477; NAS 1.15:211726; IECEC-2002-20072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the position sensorless algorithms presently used in the motor control for the NASA "in-house" development work of the flywheel energy storage system. At zero and low speeds a signal injection technique, the self-sensing method, is used to determine rotor position. At higher speeds, an open loop estimate of the back EMF of the machine is made to determine the rotor position. At start up, the rotor is set to a known position by commanding dc into one of the phase windings. Experimental results up to 52,000 rpm are presented.

Author

Algorithms; Flywheels; Energy Storage; Motors

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20020067718 Corps of Engineers, Washington, DC USA

Engineering and Design: Precipitation/Coagulation/Flocculation

Nov. 15, 2001; 102p; In English; Original contains color images

Report No.(s): AD-A403850; EM-1110-1-4012; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This engineer manual (EM) was written to provide guidance for determining if precipitation, coagulation, flocculation (P/C/F) systems are applicable and guidance on how to properly design, specify, and operate P/C/F systems to remove dissolved heavy metals from aqueous waste streams.

DTIC

Water Pollution; Heavy Metals; Coagulation; Flocculating

20020067727 NASA Goddard Inst. for Space Studies, New York, NY USA

Climatic and Chemical Controls on Methane Emissions from Wetlands

Matthews, Elaine, NASA Goddard Inst. for Space Studies, USA; Gauci, Vincent, Open Univ., UK; Prigent, Catherine, Observatoire de Paris, France; [2002]; 1p; In English; Society of Wetland Scientists Meeting, 3-7 Jun. 2002, Lake Placid, NY, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Natural wetlands are the largest single source of methane to the atmosphere and the only one dominated by climate. Although interannual variations in methane emissions from short-term climate variations are becoming better understood, major uncertainties remain with respect to the sensitivity of wetlands and their CH₄ emissions to climate variability, the sensitivity of suppression of wetland methane missions to changes in low-dose sulfate deposition, and the response of wetland dynamics to climate variations. We present results from modeling, field, and remote sensing research that integrate current understanding of the dynamics of wetlands and their methane emissions.

Author

Climate; Methane; Wetlands; Remote Sensing; Emission

20020067728 NASA Goddard Space Flight Center, Greenbelt, MD USA

Elementary Theory of Covariance Modeling

Cohn, S., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; NATO Advanced Study Institute, 19 May - 1 Jun. 2002, Maratea, Italy; Sponsored by NATO Advanced Study Inst., Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The contents include: 1. State space, spectral space, and observation space; 2. Variances and correlations; 3. Isotropic and anisotropic correlation modeling on the sphere; 4. Operational ozone data assimilation; and 5. Kalman filtering for trace constituents.

CASI

Covariance; Mathematical Models; Data Acquisition; Anisotropy

20020068075 Maryland Univ., Wye Research and Education Center, Queenstown, MD USA

Chlorine Dioxide: The State of Science, Regulatory, Environmental Issues, and Case Histories

Burton, Dennis T.; Fisher, Daniel J.; Feb. 16, 2001; 16p; In English

Report No.(s): AD-A403858; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of chlorine by electric utilities and other surface water users to inhibit biofouling and the chlorination of wastewater by POTWs to eliminate the discharge of pathogenic organisms are widespread practices. A number of surface water users in the Great Lakes region recently expressed an interest in using chlorine to control the zebra mussel (*Dreissena polymorpha*) which was introduced from Europe in the mid-1980s. It is well known, however, that chlorine-produced oxidants may be toxic to aquatic life when discharged into receiving waters. In addition, chlorine reacts with ammonia and chlorinated hydrocarbons to form various chloramines and trihalomethanes, which have long half-lives and similar toxicities relative to free chlorine (Fisher et al. 1999).

DTIC

Waste Water; Toxicity; Ecosystems; Organisms; Marine Biology; Chlorine

20020068891 Army Engineer Research and Development Center, Environmental Lab., Vicksburg, MS USA

Tri-Service Site Characterization and Analysis Penetrometer System Validation of the Membrane Interface Probe Final Report

Myers, Karen F.; Davis, William M.; Costanza, Jed; Jul. 2002; 62p; In English

Report No.(s): AD-A403916; ERDC/EL-TR-02-16; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Site characterization for subsurface contaminants is time consuming and costly. The Site Characterization and Analysis Penetrometer System (SCAPS) Ion Trap Mass Spectrometer - Membrane Interface Probe (ITMS-MIP) system was developed to respond to the need for real-time, in situ measurements of subsurface volatile organic compound (VOC) contamination at hazardous waste sites. The ITMS-MIP system performs rapid field screening to determine the presence or absence of subsurface volatile organic contaminants. The Membrane Interface Probe developed by Geoprobe Systems, Inc., was coupled with the direct sampling ITMS to provide in situ measurement of VOCs in the subsurface. The ITMS-MIP system was demonstrated at five geographically different hazardous waste sites. The ITMS-MIP was found to perform best in saturated soils. Results from the saturated zone show a good correlation with U.S. Environmental Protection Agency validation methods for co-located samples with a linear regression coefficient of 0.95 and a slope of 1.42 for trichloroethene. Correlations for vadose zone samples showed differences in soil types and moisture content. The ITMS-MIP was successfully demonstrated as a qualitative screening tool at these sites. The SCAPS ITMS-MIP system was demonstrated to reduce the time and cost required to characterize sites by directing the placement of a reduced number of conventional soil bores and monitoring wells.

DTIC

Penetrometers; Ground Water; Organic Compounds; Volatility; Mass Spectrometers; Ion Traps (Instrumentation)

20020068895 Army Engineer Research and Development Center, Environmental Lab., Vicksburg, MS USA

Cost and Performance Report for Tri-Service Site Characterization and Analysis Penetrometer System (SCAPS) Membrane Interface Probe Final Report

Myers, Karen F.; Costanza, Jed; Davis, William M.; Jan. 2002; 42p; In English

Report No.(s): AD-A403904; ERDC/EL-TR-02-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The SCAPS (Site Characterization and Analysis Penetrometer System) ion trap mass spectrometer-Membrane Interface Probe (ITMS-MIP) system was developed to respond to the need for real-time, in situ measurements of subsurface volatile organic compounds (VOC) contamination at hazardous waste sites. The MIP, developed by Geoprobe Systems, Inc., was coupled with the ITMS to provide a system capable of sampling and analyzing up to 38 samples per day. During two site characterization demonstrations in 1999 and 2000, the ITMS-MIP was used to determine the vertical extent of trichloroethene (TCE) contamination at a site at the Naval Air Station North Island. Use of the ITMS-MIP system realized cost savings of 25 percent over sampling and analysis of existing monitoring wells by conventional methods.

DTIC

Cost Analysis; Penetrometers; Ground Water; Water Pollution; Mass Spectrometers; Volatile Organic Compounds

20020069017 NASA Ames Research Center, Moffett Field, CA USA

Long Term Manipulations of Intact Microbial Mat Communities in a Greenhouse Collaboratory: Simulating Earth's Present and Past Field Environments

Bebout, Brad, NASA Ames Research Center, USA; DesMarais, David J., NASA Ames Research Center, USA; Discipulo, Mykell, Search for Extraterrestrial Intelligence Inst., USA; Embaye, Tsegereda, Search for Extraterrestrial Intelligence Inst., USA; Garcia-Pichel, Ferran, Arizona State Univ., USA; Hogan, Mary, California Univ., USA; Jahnke, Linda L., NASA Ames Research Center, USA; Keller, Richard M., NASA Ames Research Center, USA; Miller, Scott R., North Carolina State Univ., USA; Prufert-Bebout, Leslie E., NASA Ames Research Center, USA; Apr. 15, 2002; 30p; In English

Contract(s)/Grant(s): RTOP 344-50-92-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Photosynthetic microbial mat communities were obtained from marine hypersaline saltern ponds, maintained in a greenhouse facility, and examined for the effects of salinity variations. Because these microbial mats are considered to be useful analogs of equivalent ancient marine communities, they offer insights about evolutionary events during the greater than 3 billion year time interval wherein mats co-evolved with Earth's geosphere and atmosphere. Although photosynthetic mats can be highly dynamic and exhibit extremely high activity, the mats in the present study have been maintained for more than one year with relatively minor changes. The major groups of microorganisms, as assayed using microscopic, genetic, and biomarker methodologies, are essentially the same as those in the original field samples. Field and greenhouse mats were similar with respect to rates of exchange of oxygen and dissolved inorganic carbon across the mat-water interface, both during the day and at night. Field and greenhouse mats exhibited similar rates of efflux of methane and hydrogen. Manipulations of salinity in the water overlying the mats produced changes in the community that strongly resemble those observed in the field. A collaboratory testbed and an array of automated features are being developed to support remote scientific experimentation with the assistance of intelligent software agents. This facility will permit teams of investigators to explore ancient environmental conditions that are rare or absent today but might have influenced the early evolution of these photosynthetic ecosystems.

Author

Salinity; Microorganisms; Primitive Earth Atmosphere; Marine Biology; Biogeochemistry; Atmospheric Composition; Ecosystems

20020069094 PSI Technology Co., Andover, MA USA

Recovery and Sequestration of CO₂ from Stationary Combustion Systems by Photosynthesis of Microalgae Quarterly Report, 1 Oct. 2000 - 30 Sep. 2001

Nakamura, T.; Olaizola, M.; Masutani, S. M.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-793306; PSI-1356; No Copyright; Avail: National Technical Information Service (NTIS)

Most of the anthropogenic emissions of carbon dioxide result from the combustion of fossil fuels for energy production. Photosynthesis has long been recognized as a means, at least in theory, to sequester anthropogenic carbon dioxide. Aquatic microalgae have been identified as fast growing species whose carbon fixing rates are higher than those of land-based plants by one order of magnitude. Physical Sciences Inc. (PSI), Aquasearch, and the Hawaii Natural Energy Institute at the University of Hawaii are jointly developing technologies for recovery and sequestration of CO₂ from stationary combustion systems by photosynthesis of microalgae. The research is aimed primarily at demonstrating the ability of selected species of microalgae to effectively fix carbon from typical power plant exhaust gases. This report is the summary first year report covering the reporting period 1 October 2000 to 30 September 2001 in which PSI, Aquasearch and University of Hawaii conducted their tasks. Based on the work conducted during the previous reporting period, PSI initiated work on the component optimization work. Aquasearch continued their effort on selection of microalgae suitable for CO₂ sequestration. University of Hawaii initiated effort on system optimization of the CO₂ sequestration system.

NTIS

Carbon Dioxide; Exhaust Gases; Photosynthesis; Microorganisms

20020069111 Environmental Protection Agency, Office of Water, Washington, DC USA

Delaware River Basin Commission: Quality Assurance Project Plan 2001 Update

Jul. 2001; 56p; In English

Report No.(s): PB2002-108106; DRBC-QA2001-001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

From May through September of 2001, the Delaware River Basin Commission (DRBC) will monitor water quality of the Delaware River and tributaries located between the Delaware Water Gap and Trenton, NJ. The mission of the Lower Delaware Monitoring Program is to obtain environmental data that: expands and augments baseline water quality, physical, and biological data collection efforts of various federal, state, local, and citizen monitoring agencies; allows statistical definition of existing water

quality within five years, so that criteria may be established for development of an anti-degradation protection strategy for the Lower Delaware River corridor; enables reporting of water quality status and trends, biological response to natural and anthropogenic stressors, quantitative long and short-term changes to channel morphology of the river and its tributaries, and identification of key factors controlling maintenance and improvement of the ecological integrity of the river; supports determination of abatement priorities for point and non-point sources of pollution; allows prioritization of tributaries for monitoring and watershed planning purposes; expands ecological knowledge of the Lower Non-Tidal Delaware River; and helps to safeguard the health and safety of the river-using public.

NTIS

Water Quality; Biological Effects; Quality Control; Project Planning

20020069127 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Variable-Resolution Stretched-Grid General Circulation Model and Data Assimilation System with Multiple Areas of Interest: Studying the Anomalous Regional Climate Events of 1998

Fox-Rabinovitz, Michael S., NASA Goddard Space Flight Center, USA; Takacs, Lawrence, NASA Goddard Space Flight Center, USA; Govindaraju, Ravi C., NASA Goddard Space Flight Center, USA; [2002]; 63p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The new stretched-grid design with multiple (four) areas of interest, one at each global quadrant, is implemented into both a stretched-grid GCM (general circulation model) and a stretched-grid data assimilation system (DAS). The four areas of interest include: the U.S./Northern Mexico, the El Nino area/Central South America, India/China, and the Eastern Indian Ocean/Australia. Both the stretched-grid GCM and DAS annual (November 1997 through December 1998) integrations are performed with 50 km regional resolution. The efficient regional down-scaling to mesoscales is obtained for each of the four areas of interest while the consistent interactions between regional and global scales and the high quality of global circulation, are preserved. This is the advantage of the stretched-grid approach. The global variable resolution DAS incorporating the stretched-grid GCM has been developed and tested as an efficient tool for producing regional analyses and diagnostics with enhanced mesoscale resolution. The anomalous regional climate events of 1998 that occurred over the U.S., Mexico, South America, China, India, African Sahel, and Australia are investigated in both simulation and data assimilation modes. Tree assimilated products are also used, along with gauge precipitation data, for validating the simulation results. The obtained results show that the stretched-grid GCM and DAS are capable of producing realistic high quality simulated and assimilated products at mesoscale resolution for regional climate studies and applications.

Author

Data Acquisition; Atmospheric General Circulation Models; Climatology; Computational Grids

20020069140 NASA Marshall Space Flight Center, Huntsville, AL USA

Earth Occultation Techniques

Wilson, Colleen A., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 Summer Course of the International Advanced School Leonardo da Vinci, 3 Jul. 2002, Bologna, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Earth occultation is a familiar phenomenon to all residents of the Earth, although most know it as sunrise and sunset. Satellites observe Earth occultations of an astrophysical source when it sets behind or rises above the Earth's horizon (also called the Earth's limb). Two occultations, a rise and a set, occur every satellite orbit. The most extensive use of Earth occultation to measure sources was with the Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (CGRO) for 9 years. The entire sky was subject to Earth occultation for some portion of CGRO's precession period. In BATSE data, atmospheric attenuation produced step-like features when astrophysical sources underwent occultation. The observed change in count rate in several energy bands provided a measurement of the source intensity and spectrum without requiring sophisticated background models. I will describe (1) a brief history of occultation techniques in X-ray and gamma ray astronomy; (2) how occultation features were used to locate and monitor astrophysical sources with BATSE and (3) how the Earth occultation technique can be applied to future instruments.

Author

Gamma Ray Astronomy; Gamma Ray Bursts; Occultation; Earth Limb

20020069149 NASA Ames Research Center, Moffett Field, CA USA

Rationalizing Burned Carbon with Carbon Monoxide Exported from South America

Chatfield, R., NASA Ames Research Center, USA; Freitas, S. R., Sao Paulo Univ., Brazil; SilvaDias, M. A., Sao Paulo Univ., Brazil; SilvaDias, P. O., Sao Paulo Univ., Brazil; [2002]; 1p; In English; Large-Scale Biosphere-Atmosphere Experiment in Amazonia Scientific Conference, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present several estimates cross-checking the fluxes of carbon to the atmosphere from burning, comparing models that are based on simple land-surface parameterizations and atmospheric transport dynamics. Both estimates made by NASA Ames and USP modeling techniques are quite high compared to some detailed satellite/land-use studies of emissions. The flux of carbon liberated to the atmosphere via biomass burning is important for several reasons. This flux is a fundamental statistic for the parameterization of the large-scale flux of gases controlling the reactive greenhouse gases methane and ozone. Similarly, it is central to the estimation of the translocation of nitrogen and pyrodenitrification in the tropics. Thirdly, CO₂ emitted from rainforest clearing contributes directly to carbon lost from the rainforest system as it contributes to greenhouse gas forcing. While CO₂ from pasture, agriculture, etc, is considered to be reabsorbed seasonally, and so "off budget" for the carbon cycle, it must also be accounted. CO₂ anomalies related to daily weather and interannual climatic variation are strong enough to perturb our scientific perception of long-term carbon storage trends. We compare fluxes deduced from land-use statistics (originally, W.M. Hao) and from satellite hot pixels (A. Setzer) with atmospheric fluxes determined by the mesoscale/continental scale models RAMS and MM5, and point to some new work with highly resolved global models (the NASA Data Assimilation Office's GEOS4). Our simulations are tied to events, so that measured tracers like CO tie the models directly to the burning and meteorology of a specific period. We point out a particular sensitivity in estimates based on CO, and indicate how analysis of CO₂ along with other biomass-burning tracers may lead to an improved multi-species estimator of carbon burned.

Author

Atmospheric Circulation; Atmospheric Models; Biomass Burning; Carbon; Carbon Monoxide; South America; Scale Models

20020070201 NASA Goddard Space Flight Center, Greenbelt, MD USA

Validation of TOMS Aerosol Products using AERONET Observations

Bhartia, P. K., NASA Goddard Space Flight Center, USA; Torres, O., Maryland Univ. Baltimore County, USA; Sinyuk, A., Maryland Univ. Baltimore County, USA; Holben, B., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Total Ozone Mapping Spectrometer (TOMS) aerosol algorithm uses measurements of radiances at two near UV channels in the range 331-380 nm to derive aerosol optical depth and single scattering albedo. Because of the low near UV surface albedo of all terrestrial surfaces (between 0.02 and 0.08), the TOMS algorithm has the capability of retrieving aerosol properties over the oceans and the continents. The Aerosol Robotic Network (AERONET) routinely derives spectral aerosol optical depth and single scattering albedo at a large number of sites around the globe. We have performed comparisons of both aerosol optical depth and single scattering albedo derived from TOMS and AERONET. In general, the TOMS aerosol products agree well with the ground-based observations. Results of this validation will be discussed.

Author

Algorithms; Oceans; Optical Thickness; Total Ozone Mapping Spectrometer; Aerosols; Robotics

20020070214 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report. Membrane System for the Recovery of Volatile Organic Compounds from Remediation Off-Gases: Industry Programs and TRU and Mixed Waste Focus Area

Sep. 2001; 32p; In English

Report No.(s): DE2002-795003; DOE/EM-0614; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Membrane Technology and Research, Inc.'s (MTR's) membrane-based off-gas treatment technology separates the organic components from the off-gas stream, producing a VOC-free air stream that can be discharged or recycled to the gas-generating process. The membrane system produces a constant, high-quality air discharge stream irrespective of the feed-air composition. The system also produces a concentrated liquid VOC stream for disposal. Any water vapor present in the off-gas is removed as condensed dischargeable water. Benefits: Applicable to a broad range of off-gas generating sources. Target streams are off-gas from soil remediation by in situ vacuum extraction or air and steam sparging, and soil vitrification Suitable for remote sites: systems require minimal site preparation, little operator attention once installed, electrical power but no other utilities, and no expendable chemicals Minimizes waste volume: dischargeable air and water are produced, and VOCs removed from the feed gas are concentrated into a condensed liquid. No other waste streams result Treats off-gases containing both flammable and nonflammable and chlorinated and nonchlorinated VOCs Cost competitive with other technologies in the VOC concentration range 100-1,000 ppm and offers significant cost reduction at higher VOC concentrations Systems are easily moved and transported to new sites with a minimum of refurbishing or modification Generates no air emissions, minimizing permitting issues

and speeding up the start of a clean-up operation Technology: Removal of VOCs from air streams with membranes is a relatively new technology.

NTIS

Membranes; Organic Compounds; Air Flow; Nonflammable Materials; Volatile Organic Compounds

20020070354 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

EPA Air Pollution Control Cost Manual. Sixth Edition

Jan. 2002; 670p; In English

Report No.(s): PB2002-108214; EPA/452/B-02/001; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

+The Manual provides up-to-date information on point source and stationary area source air pollution controls for volatile organic compounds (VOCs), particulate matter (PM), oxides of nitrogen (NOX), and some acid gasses (primarily SO₂ and HCl). The control devices included in this Manual are generally well established devices with a long track record of performance. The objectives of this Manual are two-fold: (1) to provide guidance to industry and regulatory authorities for the development of accurate and consistent costs (capital costs, operating and maintenance expenses, and other costs) for air pollution control devices, and (2) to establish a standardized and peer reviewed costing methodology by which all air pollution control costing analyses can be performed. To perform these objectives, this Manual, for the last twenty-five years, has compiled up-to-date information for 'add-on' (downstream of an air pollution source) air pollution control systems and provided a comprehensive, concise, consistent, and easy-to-use procedure for estimating and (where appropriate) escalating these costs.

NTIS

Cost Analysis; Manuals; Air Pollution; Control Equipment

20020070367 Research Triangle Inst., Research Triangle Park, NC USA

Novel Technologies for Gaseous Contaminants Control Final Report, 1 Oct. 1999 - 30 Sep. 2001

Turk, B. S.; Merkel, T.; Lopez-Ortiz, A.; Gupta, R. P.; Portzer, J. W.; Sep. 2001; 128p; In English

Report No.(s): DE2002-793531; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The overall objective of this project is to develop technologies for cleaning/conditioning the syngas from an integrated gasification combined cycle (IGCC) system to meet the tolerance limits for contaminants such as H₂S, COS, NH₃, HCN, HCl, and alkali for fuel cell and chemical production applications. RTI's approach is to develop a modular system that (1) removes reduced sulfur species to sub-ppm levels using a hybrid process consisting of a polymer membrane and a regenerable ZnO-coated monolith or a mixed metal oxide sorbent; (2) removes hydrogen chloride vapors to sub-ppm levels using an inexpensive, high-surface area material; and (3) removes NH₃ with acidic adsorbents. RTI is working with MEDAL, Inc., and North Carolina State University (NCSSU) to develop polymer membrane technology for bulk removal of H₂S from syngas. These membranes are being engineered to remove the acid gas components (H₂S, CO₂, NH₃, and H₂O) from syngas by focusing on the 'solubility selectivity' of the novel polymer compositions. The desirable components of the syngas (H₂ and CO) are maintained at high-pressure conditions as a non-permeate stream while the impurities are transported across the membrane to the low pressure side. RTI tested commercially available and novel materials from MEDAL using a high-temperature, high-pressure (HTHP) permeation apparatus.

NTIS

Contaminants; Synthesis Gas; Metal Oxides; Gasification

20020070370 NASA Goddard Space Flight Center, Greenbelt, MD USA

Seasonal Characteristics of Tropical Ozone Profiles using the SHADOZ Ozone Sonde Data Set: Comparisons with TOMS Tropical Ozone Climatology

Witte, J. C., Science Systems and Applications, Inc., USA; Thompson, A. M., Science Systems and Applications, Inc., USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Advances in tropospheric ozone data products being developed for tropical and subtropical regions using TOMS (Total Ozone Mapping Spectrometer) and other satellites are motivating efforts to renew and expand the collection of balloon-borne ozonesonde observations. The SHADOZ (Southern Hemisphere Additional OZonesondes) project is a web-based archive established since 1998. Its goals are to support validation of TOMS and SBUV (Solar Backscatter UV) satellite ozone measurements and to improve remote sensing techniques for estimating tropical and subtropical ozone. Profile data are taken from balloon-borne ozonesondes, currently at 11 stations coordinating weekly to bi-weekly launches. Station data are publically available at a central location via the internet: <http://code916.gsfc.nasa.ov/Data_services/shadoz>. Since the start of the project, the SHADOZ archive has accumulated over 1500 ozonesonde profiles. Data also includes measurements from various SHADOZ

supported field campaigns, such as, the Indian Ocean Experiment (INDOEX), Sounding of Ozone and Water in the Equatorial Region (SOWER) and Aerosols99 Atlantic Cruise. Using data from the archive, profile climatologies from selected stations will be shown to 1/characterize the variability of tropospheric tropical ozone among stations, 2/illustrate the seasonal offsets with respect to the tropical profile used in the TOMS v7 algorithm, and 3/estimate the potential error in TOMS retrieval estimates of the tropospheric portion of the atmosphere.

Author

Climatology; Meteorological Parameters; Ozone; Solar Backscatter UV Spectrometer; Tropical Regions; Annual Variations; Sondes

20020070380 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mass Conservation in a Chemical Transport Model and its Effect on CO₂ and SF₆ Simulations

Zhu, Z., Science Systems and Applications, Inc., USA; Weaver, C., Maryland Univ. Baltimore County, USA; Kawa, S. R., NASA Goddard Space Flight Center, USA; Douglass, A. R., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Chemical transport models (CTMs) must conserve mass to be useful for applications involving assessment of the effect of various pollutants on the troposphere and stratosphere. Furthermore, calculations of the evolution of constituents such as SF₆ are used to evaluate overall model transport, and interpretation of such simulations is clouded if mass conservation is not assured. For realistic simulations or predictions, it is crucial that constituents are not produced or lost by transport or other processes in the CTMs. Analysis of CO₂ and SF₆ experiments using a CTM shows that problems with mass conservation can seriously degrade the simulations. Failure to conserve mass results from inconsistency of the surface pressure tendency and the divergence of horizontal mass flux when the model is forced by assimilated meteorological data. We have developed an effective method to eliminate the inconsistency by modifying the divergent part of the wind field. The changes in the wind fields are quite small but the impact on mass conservation is large. Parameterizations of physical processes such as convection or turbulent transport can also affect mass conservation. The lack of conservation is small but accumulates when integrations are lengthy such as required for SF₆. This lack of conservation is found using winds from either a GCM or from an assimilation system. A simple adjustment removes much of the inaccuracy in the convective parameterization. A CO₂ simulation using assimilated winds from the most recent version of the Goddard Earth Observing System Data Assimilation System will be used to illustrate the impact of these transport improvements.

Author

Carbon Dioxide; Stratosphere; Sulfur Hexafluoride; Parameterization; Computerized Simulation; Meteorological Parameters; Transport Properties; Conservation

20020070544 NASA Goddard Space Flight Center, Greenbelt, MD USA

Description and Sensitivity Analysis of the SOLSE/LORE-2 and SAGE III Limb Scattering Ozone Retrieval Algorithms

Loughman, R., Arizona Univ., USA; Flittner, D., Arizona Univ., USA; Herman, B., Arizona Univ., USA; Bhartia, P., NASA Goddard Space Flight Center, USA; Hilsenrath, E., NASA Goddard Space Flight Center, USA; McPeters, R., NASA Goddard Space Flight Center, USA; Rault, D., NASA Langley Research Center, USA; [2002]; 1p; In English; 2002 Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The SOLSE (Shuttle Ozone Limb Sounding Experiment) and LORE (Limb Ozone Retrieval Experiment) instruments are scheduled for reflight on Space Shuttle flight STS-107 in July 2002. In addition, the SAGE III (Stratospheric Aerosol and Gas Experiment) instrument will begin to make limb scattering measurements during Spring 2002. The optimal estimation technique is used to analyze visible and ultraviolet limb scattered radiances and produce a retrieved ozone profile. The algorithm used to analyze data from the initial flight of the SOLSE/LORE instruments (on Space Shuttle flight STS-87 in November 1997) forms the basis of the current algorithms, with expansion to take advantage of the increased multispectral information provided by SOLSE/LORE-2 and SAGE III. We also present detailed sensitivity analysis for these ozone retrieval algorithms. The primary source of ozone retrieval error is tangent height misregistration (i.e., instrument pointing error), which is relevant throughout the altitude range of interest, and can produce retrieval errors on the order of 10-20 percent due to a tangent height registration error of 0.5 km at the tangent point. Other significant sources of error are sensitivity to stratospheric aerosol and sensitivity to error in the a priori ozone estimate (given assumed instrument signal-to-noise = 200). These can produce errors up to 10 percent for the ozone retrieval at altitudes less than 20 km, but produce little error above that level.

Author

Ozonometry; Scattering; Sensitivity Analysis; Algorithms; Instrument Errors

20020070658 NASA Goddard Space Flight Center, Greenbelt, MD USA

Large 0/12 GMT Differences of US Vaisala RS80 Observations

Redder, Chris, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The daily differences between the temperatures and heights taken at 0 GMT and 12 GMT by Vaisala RS80 rawinsondes have been calculated. The observations were obtained during selected months from 1998 - 2002 over North America, Europe and Australia. The daily differences are defined by the formula, $\Delta T = \Delta T(\text{sub } 0) - 0.5(T(\text{sub } -12) - T(\text{sub } +12))$ where ΔT is the 0/12 GMT difference, $T(\text{sub } 0)$ is the 0 GMT observation and $T(\text{sub } -12)$ and $T(\text{sub } +12)$ are the 12 GMT observations taken just prior and after the 0 GMT synoptic time. If $T(\text{sub } +12)$ is missing then $\Delta T = T(\text{sub } 0) - T(\text{sub } -12)$. A similar expression is used if $T(\text{sub } -12)$ is missing. Monthly averages of the increments at each station that launch RS80 rawinsondes are then calculated. The results show positive systematic differences in the stratosphere with values as high as 5 K and 150 m at 10 hPa over the central USA. The values remain generally positive and gradually decrease as the levels descend into the upper troposphere but are still significant. In addition, the maximum at each level is just westward of 90 W at the highest levels and just eastward in the troposphere with smaller values along both coasts. In Canada as well as in Europe and Australia the differences are much smaller with no systematic patterns similar to those that exist over the contiguous USA. Time-series plots of the temperatures and heights at select stations in the USA show that the observed values taken at 0 GMT are consistently higher than those at 12 GMT. Over Canada the differences become much less apparent and some cases non-existent. The observations were obtained through National Centers for Environmental Prediction (NCEP) but were checked with data from other sources to verify that no modifications were made other than those at the stations. Since the data from outside the the United States exhibit no large systematic differences, the preliminary conclusion is that the large differences are artificial and probably originate from the post-processing software at the observing stations.

Author

Rawinsondes; Temperature Measurement; Altimetry

20020070659 NASA Goddard Space Flight Center, Greenbelt, MD USA

Calibration of the Shuttle Ozone Limb Sounding Experiment (SOLSE) and the Limb Ozone Retrieval Experiment (LORE)

Janz, S. J., NASA Goddard Space Flight Center, USA; Hilsenrath, E., NASA Goddard Space Flight Center, USA; McPeters, R., NASA Goddard Space Flight Center, USA; Heath, D. F., Research Support Instruments, Inc., USA; [2002]; 1p; In English; 2002 Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The calibration and characterization of two new instruments designed to retrieve ozone profiles into the lower stratosphere will be presented. These instruments will fly as a single payload on the Space Shuttle Columbia currently scheduled to lift off July 11, 2002. The purpose of SOLSE (Shuttle Ozone Limb Sounding Experiment) and LORE (Limb Ozone Retrieval Experiment) is to provide a thorough test of the limb ozone retrieval technique, which is being employed on several satellite instruments currently deployed or planned for deployment in the near future. OSIRIS (Optical Spectrograph and Infrared Imager System) and SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) are already in orbit, while OMPS (the Ozone Mapping and Profiler Suite) is planned as the primary US ozone monitoring instrument in the next decade.. SOLSE is a Czerny-Turner spectrograph utilizing a 1k x 1k cooled CCD at the focal plane and covering the spectral range of 310-380 nm in the ultraviolet and 535-865 nm in the visible to near infrared. LORE is a 5 channel filter radiometer with center band wavelengths of 322, 350, 603, 675, and 1000 nm. The focus of this paper will be on measurements of the SOLSE spectrograph performance in the limb-viewing configuration including stray light rejection, spatial and spectral resolution and absolute radiometric response.

Author

Satellite Instruments; Calibrating; Stratosphere; Ozonometry; Spectrographs; Spatial Resolution; Spectral Resolution

20020070661 NASA Goddard Space Flight Center, Greenbelt, MD USA

Non-Spherical Aerosol Phase Functions Derived from MODIS and AERONET Observations

Remer, L. A., NASA Goddard Space Flight Center, USA; Kaufman, Y. J., NASA Goddard Space Flight Center, USA; Levy, R. C., Science Systems and Applications, Inc., USA; Dubovik, O., Maryland Univ. Baltimore County, USA; [2002]; 1p; In English; 2002 American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We compare MODIS (Moderate Resolution Imaging Spectroradiometer) satellite aerosol retrievals of spectral optical thickness and size parameters over ocean with the same quantities derived from AERONET (Aerosol Robotic Network)

observations made at island and coastal sites. Over much of the globe, the satellite-derived quantities agree well with the AERONET quantities. However, in regimes dominated by desert dust aerosol, the agreement is less robust. In the dust regimes, the MODIS retrievals show greater spectral dependence and report smaller particle sizes than do the AERONET derivations. We suggest that the reason for this discrepancy is the nonspherical nature of desert dust particles, which the initial MODIS algorithm is not able to handle. Using the discrepancy between MODIS and AERONET derived spectral optical thickness as an asset, instead of a detriment, we reconstruct the aerosol phase functions that the MODIS algorithm would have needed in order to match the AERONET retrievals. No assumptions of particle shape are used in the derivation of these functions and the results are empirical total column, ambient phase functions. We compare the empirically derived phase functions with phase functions calculated from spheres and spheroids, both situations in which assumptions about particle shape must be made. The resulting empirical nonspherical phase functions will be included in future updates of the MODIS algorithm.

Author

Aerosols; Dust; Optical Thickness; Error Analysis; Deserts

20020070668 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

EPA Air Pollution Control Cost Manual. Sixth Edition *Manual de Costos de Control de Contaminacion del Aire de la EPA. Sexta Edicion*

Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM Report No.(s): PB2002-108215; EPA/452/R-02/002; No Copyright; Avail: National Technical Information Service (NTIS)

The Manual provides up-to-date information on point source and stationary area source air pollution controls for volatile organic compounds (VOCs), particulate matter (PM), oxides of nitrogen (NOX), and some acid gasses (primarily SO₂ and HCl). The control devices included in this Manual are generally well established devices with a long track record of performance. The objectives of this Manual are two-fold: (1) to provide guidance to industry and regulatory authorities for the development of accurate and consistent costs (capital costs, operating and maintenance expenses, and other costs) for air pollution control devices, and (2) to establish a standardized and peer reviewed costing methodology by which all air pollution control costing analyses can be performed. to perform these objectives, this Manual, for the last twenty-five years, has compiled up-to-date information for 'add-on' (downstream of an air pollution source) air pollution control systems and provided a comprehensive, concise, consistent, and easy-to-use procedure for estimating and (where appropriate) escalating these costs.

NTIS

Cost Analysis; Air Pollution; Manuals; Control Equipment

20020070671 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

National Emission Standards for Hazardous Air Pollutants: Metal Coil Surface Coating Background Information for Promulgated Standards

May 2002; 112p; In English

Report No.(s): PB2002-107677; EPA/453/R-02/009; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

On July 16, 1992 (57 FR 31576), the authors published a list of source categories slated for regulation under section 112(copyright). The source category list included the metal coil coating (surface coating) source category. The authors proposed standards for the metal coil surface coating source category on July 18, 2000 (65 FR 44616). The purpose of this document is to present the EPA's responses to the comments on the proposed rulemaking.

NTIS

Exhaust Emission; Exhaust Gases; Pollution Control; Standards

20020070675 Texas Southern Univ., Dept. of Transportation Studies, Houston, TX USA

Forecasting Traffic Characteristics for Air Quality Analyses *Interim Report, 1 Sep. 2000 - 31 Aug. 2001*

Yu, L.; Qiao, F.; Li, G.; Wang, X.; Mar. 2002; 98p; In English

Report No.(s): PB2002-106316; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This research intends to develop techniques for estimating and forecasting three critical mobile source emission related travel indicators: vehicle age distribution, two model types were used; each of which contains the linear model, nonlinear model and time series model. Age distributions for the 8 counties in HGAC areas in Texas were used for validating model structures and parameters. The differences between the emission factors generated by MOBILE based on the default values and the forecasted values were compared. The developed computer program can be used in the Texas cities. As for modeling the mileage accumulation rate, a correcting process was developed. The real mileage accumulation rates by some vehicle types in Houston were collected, the correcting factor and estimated mileage accumulation rates were generated. As for VMT mix, extensive efforts were made on collecting information on VMT mix estimation. A national-wide survey through e-mail was conducted to ascertain

what kinds of methodologies were being used by the other states. The evaluations of VMT mix estimation methodologies and the proposed improvements are on-going works, which will be summarized in the final report.

NTIS

Automobiles; Air Pollution; Time Series Analysis; Air Quality

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GEOPHYSICS

Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.

20020067731 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Assessment of Gravity Recovery with CHAMP Data

Lemoine, F. G., NASA Goddard Space Flight Center, USA; Luthcke, S. B., NASA Goddard Space Flight Center, USA; Rowlands, D. D., NASA Goddard Space Flight Center, USA; Cox, C. M., Raytheon Information Technology and Scientific Services, USA; Chinn, D. S., Raytheon Information Technology and Scientific Services, USA; Pavlis, D. E., Raytheon Information Technology and Scientific Services, USA; Thompson, B., Colorado Univ., USA; Nerem, R. S., Colorado Univ., USA; Ray, R., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; European Geophysical Society (EGS) XXVII General Assembly, 21-26 Apr. 2002, Nice, France; No Copyright; Avail: Issuing Activity; Abstract Only

The CHAMP mission, launched in July 2000, is the first in the series of mapping missions for the Earth's geopotential scheduled for the first decade of the new millenium. Its unique contributions compared to all the previous generation of satellites whose data have been included in Earth geopotential models are the precision global tracking with GPS data, and the availability of precision accelerometry data to model the nonconservative forces. Over the past year we have implemented extensive modifications to our GEODYN orbit determination processing code and ancillary data preprocessors to process the GPS and accelerometry data from missions such as CHAMP and GRACE. We report on the analysis of up to 60 days of CHAMP data and how these data contribute to Earth geopotential solutions where the base model is a derivative of EGM96. Preliminary results with only 12.5 days of data processed clearly show the ability of the CHAMP data to improve the modeling of the zonals (1=10 to 40), the m-dailies, the primary resonance terms, and the sectoral harmonics. We will detail the results of our calibrations of the CHAMP accelerometry and assess the quality of test solutions that include these CHAMP data.

Author

Geodesy; Gravitation; Mapping; Data Acquisition; Earth Surface

20020067760 NASA Marshall Space Flight Center, Huntsville, AL USA

Self-Consistent Magnetosphere-Ionosphere Coupling: Theoretical Studies

Khazanov, G. V., NASA Marshall Space Flight Center, USA; Newman, T. S., NASA Marshall Space Flight Center, USA; Liemohn, M. W., Michigan Univ., USA; Fok, M.-C., NASA Goddard Space Flight Center, USA; Spiro, R. W., Rice Univ., USA; [2002]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A self-consistent ring current (RC) model has been developed that couples electron and ion magnetospheric dynamics with the calculation of the electric field. Two new features were taken into account in order to close the self-consistent magnetosphere-ionosphere coupling loop. First, in addition to the RC ions, we solve an electron kinetic equation in our model. Second, using the relation of Galand and Richmond [2001], we calculate the height integrated ionospheric conductances as a function of the precipitated high energy magnetospheric electrons and ions that are produced by our code. to validate the results of our model we simulate the magnetic storm of May 2, 1986, a storm that has been comprehensively studied, and compare our results with different theoretical approaches. The self-consistent inclusion of the hot electrons and, their effect on the conductance results in deeper penetration of the magnetospheric electric field. In addition, a slight westward rotation of the potential pattern (compared to previous self-consistent results) is evident in the inner magnetosphere. This changes the hot plasma distribution, especially by allowing increased access of plasma sheet ions and electrons to low L shells.

Author

Magnetosphere-Ionosphere Coupling; Numerical Analysis; Electron Precipitation; High Temperature Plasmas; Inner Radiation Belt

20020067782 NASA Goddard Space Flight Center, Greenbelt, MD USA

Recent Results from CHAMP Tracking and Accelerometer Data Analysis

Luthcke, S. B., NASA Goddard Space Flight Center, USA; Rowlands, D. D., NASA Goddard Space Flight Center, USA;

Lemoine, F. G., NASA Goddard Space Flight Center, USA; Nerem, R. S., Colorado Univ., USA; Thompson, B., Colorado Univ., USA; Pavlis, E., Raytheon Information Technology and Scientific Services, USA; Williams, T. A., Raytheon Information Technology and Scientific Services, USA; Colombo, O. L., Maryland Univ. Baltimore County, USA; [2002]; 1p; In English; European Geophysical Society (EGS) XXVII General Assembly, 21-26 Apr. 2002, Nice, France; Sponsored by European Geophysical Society, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

The CHAMP mission's unique combination of sensors and orbit configuration will enable unprecedented improvements in modeling and understanding the Earth's static gravity field and its temporal variations. CHAMP is the first of two missions (GRACE to be launched in the early part of 02') that combine a new generation of Global Positioning System (GPS) receivers, a high precision three-axis accelerometer, and star cameras for the precision attitude determination. In order to isolate the gravity signal for science investigations, it is necessary to perform a detailed reduction and analysis of the GPS and Satellite Laser Ranging (SLR) tracking data in conjunction with the accelerometer and attitude data. Precision orbit determination based on the GPS and SLR tracking data will isolate the orbit perturbations, while the accelerometer data will be used to distinguish the non-gravitational forces from those due to the geopotential (static, and time varying). In preparation for the CHAMP and GRACE missions, extensive modifications have been made to NASA/GSFC's GEODYN orbit determination software to enable the simultaneous reduction of spacecraft tracking (e.g. GPS and SLR), three-axis accelerometer and precise attitude data. Several weeks of CHAMP tracking and accelerometer data have been analyzed and the results will be presented. Precision orbit determination analysis based on tracking data alone in addition to results based on the simultaneous reduction of tracking and accelerometer data will be discussed. Results from a calibration of the accelerometer will be presented along with the results from various orbit determination strategies.

Author

Accelerometers; Satellite Tracking; Space Missions; Data Processing; Geodesy; Earth Gravitation

20020067784 NASA, Washington, DC USA

Auroral Substorm Time Scales: Seasonal and IMF Variations

Chua, D., Washington Univ., USA; Parks, G. K., California Univ., USA; Brittnacher, M., Washington Univ., USA; Germany, G. A., Alabama Univ., USA; Spann, J. F., NASA, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The time scales and phases of auroral substorm, activity are quantied in this study using the hemispheric power computed from Polar Ultraviolet Imager (UVI) images. We have applied this technique to several hundred substorm events and we are able to quantify how the characterist act, of substorms vary with season and IMF Bz orientation. We show that substorm time scales vary more strongly with season than with IMF Bz orientation. The recovery time for substorm. activity is well ordered by whether or not the night side oral zone is sunlit. The recovery time scales for substorms occurring in the winter and equinox periods are similar and are both roughly a factor of two longer than in summer when the auroral oval is sunlit. Our results support the hypothesis that the ionosphere plays an active role in governing the dynamics of the aurora.

Author

Auroras; Magnetic Storms; Annual Variations

20020067787 NASA Marshall Space Flight Center, Huntsville, AL USA

Distinguishing Indigenous from Contaminating Microorganisms in Rock Samples from a Deep Au Mine in South Africa

Onstott, T. C., Princeton Univ., USA; Moser, D. P., Pacific Northwest National Lab., USA; Fredrickson, J. K., Pacific Northwest National Lab., USA; Pfiffner, S. M., Tennessee Univ., USA; Phelps, T. J., Oak Ridge National Lab., USA; White, D. C., Tennessee Univ., USA; Peacock, A., Tennessee Univ., USA; Balkwill, D., Florida State Univ., USA; Hoover, R. B., NASA Marshall Space Flight Center, USA; Krumholz, L., Oklahoma Univ., USA; [2002]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The concentration and distribution of microbial biomass within deep subsurface rock strata is not well known to date, most analyses are from water samples and a few cores. Hand samples, block samples and cores from an actively mined Carbon Leader ore zone at 3.2 kilometers depth were collected for microbial analyses. The Carbon Leader was comprised of quartz, S-bearing aromatic hydrocarbons, Fe(III) oxyhydroxides, sulfides, uraninite, Au and minor amounts of sulfate. The porosity of the ore was 1% and the maximum pore throat diameter was less than 0.1 microns; whereas, the porosity of the adjacent quartzite was .02 to .9% with a maximum pore throat diameter of 0.9 microns. Rhodamine dye, fluorescent microspheres, microbial enrichments, autoradiography, phospholipid fatty acid (PLEA) and 16S rDNA analyses were performed on these rock samples and the mining water. The data indicate that the levels of solute contamination less than 0.01% for pared rock samples. Despite this low level of contamination, PLEA, microbial enrichment, DNA and tracer analyses and calculations indicate that most of the viable microorganisms in the Carbon Leader represent gram negative aerobic heterotrophs and ammonia oxidizers that are phylogenetically identical or closely related to service water microorganisms. These microbial contaminants probably infiltrated

the low permeability rock through mining-induced microfractures. Geochemical data also detected drilling water in a fault zone approx. 1 meter behind the rock face encountered during coring. The mining induced macrofractures that are common at these great depths act as pathways for the drilling water borne microorganisms into the lower temperature zone that extends several meters into rock strata from the rock face. Combined PLEA and T-RFLP analyses of the service water and Carbon Leader samples indicate that the concentration of indigenous microorganisms was less than $10(\text{exp } 2)$ cells/gram. Such a low concentrations result from the submicron pore throat diameters. PLFA, SO₄-35 autoradiography and tracer analyses indicate that the bounding quartzite contains thermophilic sulfate reducing bacteria at $10(\text{exp } 3)$ cells/gram that are not attributable to drilling water contamination. The microorganisms may be surviving on sulfate generated by oxidation of sulfide by radiolytic reactions resulting from the high U concentration in the ore zone. The presence of up to 8,000 ppm of Fe(III) oxyhydroxides in the host rock will also act to recycle sulfide generated by the sulfate reducing bacteria into sulfate. The activity of these sulfate-reducing bacteria may be enhanced by mining induced fracturing which can propagate up to 40 meters into virgin rock where the temperatures are ca. 50 C, and decrepitate of sulfate rich fluid inclusions. In ultra deep mines, judicious application of tracers and multiple microbial characterization techniques can distinguish microbial contamination caused by the near field fracturing and drilling water migration from the indigenous microbial communities in rock strata. The importance of far field fracturing on indigenous microbial communities, however, remains unknown.

Author

Bacteria; Biomass; Contaminants; Fractures (Materials); Geochemistry; Microorganisms; Minerals

20020067790 NASA Marshall Space Flight Center, Huntsville, AL USA

Long-Term Properties of Accretion Discs in X-ray Binaries, 1, The Variable Third Period in SMC X-1

Charles, P. A.; Clarkson, W. I.; Coe, M. J.; Laycock, S.; Tout, M.; Wilson, C.; [2002]; 1p; In English; Copyright; Avail: Issuing Activity; Abstract Only

Long term X-ray monitoring data from the RXTE All Sky Monitor (ASM) reveal that the third (superorbital) period in SMC X-1 is not constant but varies between 40-60 days. A dynamic power spectrum analysis indicates that the third period has been present continuously throughout the five years of ASM observations. This period changed smoothly from 60 days to 45 days and then returned to its former value, on a timescale of approximately 1600 days. During the nearly 4 years of overlap between the CGRO & RXTE missions, the simultaneous BATSE hard X-ray data confirm this variation in SMC X-1. Sources of systematic error and possible artefacts are investigated and found to be incapable of reproducing the results reported here. Our discovery of such an instability in the superorbital period of SMC X-1 is interpreted in the context of recent theoretical studies of warped, precessing accretion discs. We find that the behaviour of SMC X-1 is consistent with a radiation - driven warping model.

Author

X Rays; Binary Stars; Data Acquisition; Spectrum Analysis; Gamma Ray Bursts

20020068061 NASA Marshall Space Flight Center, Huntsville, AL USA

Ring Current Ion Coupling with Electromagnetic Ion Cyclotron Waves

Khazanov, G. V., NASA Marshall Space Flight Center, USA; Gamayunov, K. V., Alaska Univ., USA; Jordanova, V. K., New Hampshire Univ., USA; [2002]; 1p; In English; Spring AGU, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A new ring current global model has been developed that couples the system of two kinetic equations: one equation describes the ring current (RC) ion dynamic, and another equation describes wave evolution of electromagnetic ion cyclotron waves (EMIC). The coupled model is able to simulate, for the first time self-consistently calculated RC ion kinetic and evolution of EMIC waves that propagate along geomagnetic field lines and reflect from the ionosphere. Ionospheric properties affect the reflection index through the integral Pedersen and Hall conductivities. The structure and dynamics of the ring current proton precipitating flux regions, intensities of EMIC global RC energy balance, and some other parameters will be studied in detail for the selected geomagnetic storms.

Author

Ion Cyclotron Radiation; Ring Currents; Geomagnetism; Magnetic Storms; Ionospheric Conductivity; Coupled Modes; Mathematical Models

20020068074 Office National d'Etudes et de Recherches Aerospatiales, Chemin de la Huniere, Palaiseau, France

Analysis and Modeling of AFRL 'Gap 98' Balloon-Borne Measurements Final Report, 22 Sep. 2000-22 Sep 2001

Louvet, Yolande; Mar. 13, 2002; 175p; In English

Contract(s)/Grant(s): F61775-00-WE072

Report No.(s): AD-A403774; EOARD-SPC-00-4072; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report results from a contract tasking Office or National Establishment for Aerospace Research (ONERA) as follows: The objective of this project is to validate data collected on a French research balloon ('SPIRALE') successfully flown from Gap on 29 June 99. SPIRALE was funded by CNES/ONERA/INSU and developed by ONERA/LPCE to measure atmospheric trace gases (CO, O₃, CH₄, H₂O, NO₂, NO, O₂, H₂O, HF, and others) from 13 to 35 km. Another test campaign (Gap 98") was conducted during June 98 with AFRL balloon-borne sensors above the Gap-Tallard Aerodrome, in southern France. The contractor shall evaluate previously collected data from both balloon experiments and determine if the measured data validates turbulence and radiance propagation codes at middle altitudes and latitudes. The contractor will complete the following tasks: (1) Determine the ozone profile structure as a function of air mass temperature; (2) Evaluate the possible correlation of measured data with local wind shear and ozone measurements from other instruments; and (3) Model the luminance fluctuation and optical turbulence derived from the temperature fluctuation data.

DTIC

Balloon-Borne Instruments; Mathematical Models; Atmospheric Models; Trace Contaminants; Atmospheric Composition

20020068099 NASA Marshall Space Flight Center, Huntsville, AL USA

Plasmaspheric Erosion via Plasmasphere Coupling to Ring Current Plasmas: EUV Observations and Modeling

Adrian, M. L., NASA Marshall Space Flight Center, USA; Gallagher, D. L., NASA Marshall Space Flight Center, USA; Khazanov, G. V., NASA Marshall Space Flight Center, USA; Chsang, S. W., NASA Marshall Space Flight Center, USA; Liemohn, M. W., NASA Marshall Space Flight Center, USA; Perez, J. D., NASA Marshall Space Flight Center, USA; Green, J. L., NASA Marshall Space Flight Center, USA; Sandel, B. R., NASA Marshall Space Flight Center, USA; Mitchell, D. G., NASA Marshall Space Flight Center, USA; Mende, S. B., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

During a geomagnetic storm on 24 May 2000, the IMAGE Extreme Ultraviolet (EUV) camera observed a plasmaspheric density trough in the evening sector at L-values inside the plasmopause. Forward modeling of this feature has indicated that plasmaspheric densities beyond the outer wall of the trough are well below model expectations. This diminished plasma condition suggests the presence of an erosion process due to the interaction of the plasmasphere with ring current plasmas. We present an overview of EUV, energetic neutral atom (ENA), and Far Ultraviolet (FUV) camera observations associated with the plasmaspheric density trough of 24 May 2000, as well as forward modeling evidence of the existence of a plasmaspheric erosion process during this period. FUV proton aurora image analysis, convolution of ENA observations, and ring current modeling are then presented in an effort to associate the observed erosion with coupling between the plasmasphere and ring-current plasmas.

Author

Erosion; Extreme Ultraviolet Radiation; Plasmas (Physics); Plasmasphere; Ring Currents; Mathematical Models

20020068482 NASA Ames Research Center, Moffett Field, CA USA

Homogenous Surface Nucleation of Solid Polar Stratospheric Cloud Particles

Tabazadeh, A., NASA Ames Research Center, USA; Hamill, P., San Jose State Univ., USA; Salcedo, D., California Inst. of Tech., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A general surface nucleation rate theory is presented for the homogeneous freezing of crystalline germs on the surfaces of aqueous particles. While nucleation rates in a standard classical homogeneous freezing rate theory scale with volume, the rates in a surface-based theory scale with surface area. The theory is used to convert volume-based information on laboratory freezing rates (in units of cu cm, seconds) of nitric acid trihydrate (NAT) and nitric acid dihydrate (NAD) aerosols into surface-based values (in units of sq cm, seconds). We show that a surface-based model is capable of reproducing measured nucleation rates of NAT and NAD aerosols from concentrated aqueous HNO₃ solutions in the temperature range of 165 to 205 K. Laboratory measured nucleation rates are used to derive free energies for NAT and NAD germ formation in the stratosphere. NAD germ free energies range from about 23 to 26 kcal mole, allowing for fast and efficient homogeneous NAD particle production in the stratosphere. However, NAT germ formation energies are large (greater than 26 kcal mole) enough to prevent efficient NAT particle production in the stratosphere. We show that the atmospheric NAD particle production rates based on the surface rate theory are roughly 2 orders of magnitude larger than those obtained from a standard volume-based rate theory. Atmospheric volume and surface production of NAD particles will nearly cease in the stratosphere when denitrification in the air exceeds 40 and 78%, respectively. We show that a surface-based (volume-based) homogeneous freezing rate theory gives particle production rates, which are (not) consistent with both laboratory and atmospheric data on the nucleation of solid polar stratospheric cloud particles.

Author

Polar Meteorology; Stratosphere; Ice Clouds; Nucleation; Freezing

20020068834 Alabama Univ., AL USA

Consequences of Coupled Electromagnetic-Gravitational Fields

Smalley, Larry, Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLVIII-1 - XLVIII-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the late 1980s there was a flurry of activities involving the newly discovered high Tc superconductors in the development of new devices such as more efficient current transmission, transformers, generators, and motors. One such developmental project by Podkletnov in 1992 noted some small, anomalous gravitational behaviors. A following unpublished paper by Podkletnov 1995 provided data with larger effects using a larger (approx. 25 cm) superconducting disk. Unfortunately this disk was extremely fragile and was broken beyond repair. to date, these experiments have not been successfully repeated because of the difficulties of producing stable, durable (and fired) superconducting disks. This problem with firing these disks has been solved by Li. What remains is to install the disk in "motor", at superconducting temperatures in the presence of appropriately tailored magnetic fields. Derived from text

High Temperature Superconductors; Gravitational Fields; Electromagnetic Fields; Coupling; Rotating Fluids

20020068900 NASA Ames Research Center, Moffett Field, CA USA

Noachian Martian Volcanics a Water Source

Zent, A. P., NASA Ames Research Center, USA; Glaze, L. S., NASA Ames Research Center, USA; Baloga, S. M., NASA Ames Research Center, USA; [2001]; 1p; In English; 33rd Division of Planetary Science Conference, 27 Nov. - 1 Dec. 2001, New Orleans, LA, USA

Contract(s)/Grant(s): RTOP 344-30-11-02; No Copyright; Avail: Issuing Activity; Abstract Only

H₂O was supplied to the Noachian atmosphere by eruptions, or in association with large impacts. Most water outgassed into an extremely cold atmosphere, and condensate deposits were inevitable. High heat flow could lead to subglacial melting only if ice thicknesses were greater than 500-1000m, which is extremely unlikely. Subareal melting and flow is contingent upon temperatures periodically exceeding 273 K, and retarding evaporative loss of the flow. In still air, evaporation into a dry atmosphere is in the free convection regime, and a stream with 2 cu m/s discharge, flowing 1 m/s could persist for hundreds of days and cover distances greater than any valley reach. The zero-wind-shear condition is considered implausible however. We investigate the possibility that evaporation rates were suppressed because the atmosphere was regionally charged with H₂O as it moved over snow/ice fields. Our initial concern is precipitation from volcanic plumes. A Kilauea-style eruption on the martian surface would cover a 10km circular deposit with 10cm of H₂O, if all H₂O could be precipitated near the vent. The characteristics of the eruption at the vent, (vent size, temperature, H₂O content, etc.) are independent of the environmental conditions. The subsequent behavior of the plume, including precipitation of ash and H₂O condensate depends strongly on the environment. Hence, the proximal fate of volcanic H₂O is amenable to treatment in a model. A simple bulk thermodynamic model of the rise of an H₂O plume through a stably stratified CO₂ atmosphere, with only adiabatic cooling, produces runaway plume rise. A more complex treatment includes the effects of latent heat release, wind shear along the plume, divergence of ash and H₂O, and will yield more realistic estimates of H₂O transport in eruptive plumes. Results of these simulations will be presented.

Author

Mars Atmosphere; Temperature Effects; Evaporation; Heat Transfer; Ice; Water; Volcanic Eruptions

20020068905 Northeast Consortium for Engineering Education, Port Royal, VA USA

Molecular Dynamics of Upper Atmospheric Chemical Reactions Interim Report, 14 Jun. 1999-31 Aug. 2000

Lipson, J. B.; Aug. 31, 2000; 9p; In English

Contract(s)/Grant(s): F19628-98-C-0029; AF Proj. 9993

Report No.(s): AD-A403910; AFRL-VS-TR-2002-1580; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the period of June 14, 1999 - August 31, 2000, I worked at the Air Force Research Laboratory at Hanscom AFB (Air Force Base) under the Laboratory Scholar Postdoctoral Program and contract F19621-91-C-0029. In this time, I conducted experiments to investigate the molecular dynamics of chemical reactions that produce visible or infrared radiation in the upper atmosphere. The experiments were performed using laser pump-probe methods and detection techniques such as laser induced fluorescence (LIF) and resonantly enhanced multiphoton ionization (REMPI). The focus of this work was to gain a better understanding of some of the important processes that produce or destroy infrared-active species such as OH and NO in the mesosphere and thermosphere. During this time, I also researched and designed a new set of experiments to investigate the molecular dynamics of the interactions of O(3P) atoms with hydrocarbons. These experiments will be important for understanding

how hydrocarbons released by space vehicles traveling through the upper atmosphere will interact with O(3P) atoms, a dominant atmospheric species above 90 km.

DTIC

Laser Induced Fluorescence; Chemical Reactions; Ionization; Atmospheric Chemistry; Molecular Dynamics

20020068954 Technische Univ., Delft, Netherlands

Current and Additional Procedures for Superconducting Gravimeter Data at the Main Tidal Frequencies

Dorst, L.; 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-106070; No Copyright; Avail: National Technical Information Service (NTIS)

A superconducting gravimeter has been placed inside a hill. The Royal Observatory of Belgium (ROB) owns this instrument that measures temporal variations in gravity. The ROB uses a standard procedure to pre-process the signal and to estimate the tides from it. The search for possible alternatives or extensions of the current procedure is necessary to improve the interpretation and the quality description of the data, so that the quest for additional causes of variation in the signal will be possible, and the variations in the residual signal can decrease.

NTIS

Superconductivity; Gravimeters; Gravitation

20020069007 Lockheed Martin Missiles and Space, Missiles and Space-Sunnyvale Operations, Palo Alto, CA USA

CLAES Product Improvement by use of GSFC Data Assimilation System Final Report, 31 Jan. 1998 - 30 Sep. 2001

Kumer, J. B., Lockheed Martin Missiles and Space, USA; December 2001; 18p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-98046

Report No.(s): LMSS/GK01-155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent development in chemistry transport models (CTM) and in data assimilation systems (DAS) indicate impressive predictive capability for the movement of airparcels and the chemistry that goes on within these. This project was aimed at exploring the use of this capability to achieve improved retrieval of geophysical parameters from remote sensing data. The specific goal was to improve retrieval of the CLAES CH₄ data obtained during the active north high latitude dynamics event of 18 to 25 February 1992. The model capabilities would be used: (1) rather than climatology to improve on the first guess and the a-priori fields, and (2) to provide horizontal gradients to include in the retrieval forward model. The retrieval would be implemented with the first forward DAS prediction. The results would feed back to the DAS and a second DAS prediction for first guess, a-priori and gradients would feed to the retrieval. The process would repeat to convergence and then proceed to the next day.

Derived from text

Data Systems; Prediction Analysis Techniques; Mixing Ratios; Climatology; Assimilation

20020069079 Stockholm Univ., Meteorologiska Inst., Sweden

Water Vapour Isotopes in the Stratosphere

Ridal, M.; Sep. 2001; 66p; In English

Report No.(s): PB2002-105901; AP-38; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Water vapour can be used as a tracer of the dynamics in the stratosphere, not only because of its long lifetime but also because the inflow through the tropical tropopause follows an annual cycle. An overview of areas where we can gain new knowledge about the stratosphere and its dynamics using water vapour is given. A promising new tool for studying various processes in the stratosphere is the determination of the isotopic ratio of water vapour. Since isotopic fractionation occurs during phase changes the upper troposphere contains very low amounts of HDO. As new water vapour is produced in the stratosphere through methane oxidation the isotopic ratio will increase, reflecting the higher deuterium content of methane. A review of the main mechanisms affecting the isotopic ratio of atmospheric water is presented as well as our current understanding of the distribution of the D/H ratio of water vapour in the stratosphere.

NTIS

Water Vapor; Isotopes; Stratosphere; Fractionation; Methane

20020069099 Swedish Inst. of Space Physics, Kiruna, Sweden

Kiruna Geophysical Data, Data Summary 00/1-3 January-March 2000

Barabash, V.; 2001; 22p; In English

Report No.(s): PB2002-105899; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Kiruna Geophysical Data is a collection of results of ground-based more or less continuous measurements of upper atmosphere variables carried out at the Swedish Institute of Space Physics. Our objective with this data summary is to present current geophysical data, related to polar upper atmospheric conditions, to those who require it for their research work.

NTIS

Geophysics; Atmospheric Physics; Meteorology

20020069112 NASA Ames Research Center, Moffett Field, CA USA

Radiative Flux Changes by Aerosols from North America, Europe, and Africa over the Atlantic Ocean: Measurements and Calculations from TARFOX and ACE-2

Russell, P. B., NASA Ames Research Center, USA; Hignett, P., UK Meteorological Office, UK; Livingston, J. M., SRI International Corp., USA; Schmid, B., Bay Area Environmental Research Inst., USA; Chien, A., Symtech Corp., USA; Bergstrom, R., Bay Area Environmental Research Inst., USA; Durkee, P. A., Naval Postgraduate School, USA; Hobbs, P. V., Washington Univ., USA; Bates, T. S., National Oceanic and Atmospheric Administration, USA; Quinn, P. K., National Oceanic and Atmospheric Administration, USA; Sep. 07, 1998; 40p; In English; Fifth International Aerosol Conference, 14-18 Sep. 1998, Edinburgh, Scotland, UK

Contract(s)/Grant(s): RTOP 622-44-10-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerosol effects on atmospheric radiative fluxes provide a forcing function that is a major source of uncertainty in understanding the past climate and predicting climate change. To help reduce this uncertainty, the 1996 Tropospheric Aerosol Radiative Forcing Experiment (TARFOX) and the 1997 second Aerosol Characterization Experiment (ACE-2) measured the properties and radiative effects of American, European, and African aerosols over the Atlantic. In TARFOX, radiative fluxes and microphysics of the American aerosol were measured from the UK C-130 while optical depth spectra, aerosol composition, and other properties were measured by the University of Washington C-131A and the CIRPAS Pelican. Closure studies show that the measured flux changes agree with those derived from the aerosol measurements using several modelling approaches. The best-fit midvisible single-scatter albedos (approx. 0.89 to 0.93) obtained from the TARFOX flux comparisons are in accord with values derived by independent techniques. In ACE-2 we measured optical depth and extinction spectra for both European urban-marine aerosols and free-tropospheric African dust aerosols, using sunphotometers on the R/V Vodyanitskiy and the Pelican. Preliminary values for the radiative flux sensitivities ($\Delta \text{Flux} / \Delta \text{Optical depth}$) computed for ACE-2 aerosols (boundary layer and African dust) over ocean are similar to those found in TARFOX. Combining a satellite-derived optical depth climatology with the aerosol optical model validated for flux sensitivities in TARFOX provides first-cut estimates of aerosol-induced flux changes over the Atlantic Ocean.

Author

Aerosols; Marine Meteorology; Optical Thickness; Atlantic Ocean; Radiance

20020070219 Department of Energy, Office of Environmental Management, Washington, DC USA

Innovative Technology Summary Report: Tomographic Site Characterization Using CPT, ERT, and GPR. Industry Programs and Subsurface Contaminants Focus Area

Apr. 2000; In English

Report No.(s): DE2002-766840; DOE/EM-0517; No Copyright; Avail: National Technical Information Service (NTIS)

ARA developed a geophysical tomographic system that incorporates results from Electrical Resistivity Tomography (ERT) measurements and Ground Penetrating Radar (GPR) Tomography measurements. Both methods are useful for imaging subsurface structures and processes, however, GPR is more effective in sandy material and ERT is more effective in clayey material. CPT or drilling is used to deploy the electrodes in the subsurface.

NTIS

Tomography; Radar Measurement; Imaging Techniques; Drilling

20020070382 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Temperature of the Arctic and Antarctic Lower Stratosphere

Newman, Paul A., NASA Goddard Space Flight Center, USA; Nash, Eric R., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Workshop on Arctic Ozone Loss, 4-6 Mar. 2002, Potsdam, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

The temperature of the polar lower stratosphere during spring is the key factor in changing the magnitude of ozone loss in the polar vortices. In this talk, we will review the results of Newman et al. [2000] that quantitatively demonstrate that the polar lower stratospheric temperature is primarily controlled by planetary-scale waves. In particular, the tropospheric eddy heat flux in middle to late winter (January--February) is highly correlated with the mean polar stratospheric temperature during March. Strong midwinter planetary wave forcing leads to a warmer spring Arctic lower stratosphere in early spring, while weak midwinter forcing leads to cooler spring Arctic temperatures. In addition, this planetary wave driving also has a strong impact on the strength of the polar vortex. These results from the Northern Hemisphere will be contrasted with the Southern Hemisphere.

Author

Arctic Regions; Atmospheric Temperature; Polar Regions; Stratosphere

20020070517 NASA Goddard Space Flight Center, Greenbelt, MD USA

An X-ray Investigation of the NGC 346 Field in the SMC (2): The Field Population

Naze, Y., Liege Univ., Belgium; Hartwell, J. M., Birmingham Univ., UK; Stevens, I. R., Birmingham Univ., UK; Manfroid, J., Liege Univ., Belgium; Marchenko, S., University of Western Kentucky, USA; Corcoran, M. F., Universities Space Research Association, USA; Moffat, A. F. J., Montreal Univ., Canada; Skalkowski, G., Montreal Univ., Canada; [2002]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present results from a Chandra observation of the NGC 346 cluster, the ionizing source of N66, the most luminous H II region and the largest star formation region in the SMC. In the first part of this investigation, we have analysed the X-ray properties of the cluster itself and the remarkable star HD 5980. But the field contains additional objects of interest. In total, 79 X-ray point sources were detected in the Chandra observation and we investigate here their characteristics in details. The sources possess rather high HRs, and their cumulative luminosity function is steeper than the SMC's trend. Their absorption columns suggest that most of the sources belong to NGC 346. Using new UBVRi imaging with the ESO 2.2m telescope, we also discovered possible counterparts for 36 of these X-ray sources. Finally, some objects show X-ray and/or optical variability, and thus need further monitoring.

Author

X Rays; Cluster Analysis; Ion Emission; Imaging Techniques; UV Spectra; X Ray Sources

20020070533 Maryland Univ., Earth System Sciences Interdisciplinary Center, USA

TRMM Radar Observations of Cloud Tops in the Tropical Tropopause Layer

Alcala, C. M., Maryland Univ., USA; Dessler, A. E., Maryland Univ., USA; [2002]; 1p; In English; 2002 Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Air dehydrates to stratospheric abundances in the tropical tropopause layer (TTL). The role of overshooting convection in the dehydration process is not well understood. To study this effect, we use the TRMM (Tropical Rainfall Measuring Mission) precipitation radar (PR) to measure the altitudes of cloud tops forming in the TTL. Because the radar signal is dominated by scatter from large particles, these cloud observations imply the presence of strong convective systems with large updraft. Both winter and summer data from two different years are examined to study both interseasonal and interannual variability. The global distribution of these clouds is in good agreement with those of the surface precipitation rates. In addition, the altitude distributions of these clouds follow an exponential dependence. However, clouds over continental regions typically extend to higher altitudes in the tropics. Almost no cloud tops were observed above 20 km. Comparison between the radar cloud tops and colocated IR brightness temperature measurements reveal a large difference in both the diurnal cycle and intensity between continental and oceanic convection.

Author

Clouds (Meteorology); Tropopause; Cloud Height Indicators; Dehydration; Precipitation (Meteorology); Meteorological Radar

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20020068012 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Designing an Algorithm to Predict the Intensity of the Severe Weather Season

Freestrom, Hugh J.; Mar. 2001; 71p; In English; Original contains color images

Report No.(s): AD-A404171; AFIT/GM/ENP/02M-04; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Examination of atmospheric and oceanic circulations may explain interannual climate variability in the Northern Hemisphere on a seasonal scale. It is crucial to develop more accurate seasonal climate forecasts using both global circulation and sea surface temperature (SST) indices to aid in long-range weather forecasts. These global circulation and SST indices are becoming increasingly available to worldwide users and using them for seasonal prediction has spread not only to scientists, but also to brokerage firms, utilities, and the Department of Defense (DoD). DoD is extremely interested in long-range seasonal forecasts of severe weather for asset protection, mission planning, and worldwide operations. The goal of this research was to create a predictive algorithm for locations in the southeastern and south-central portion of the USA in support of the Air Force Combat Climatology Center (AFCCC) to use in predicting the intensity of the spring and summer severe weather seasons.

DTIC

Atmospheric Turbulence; Weather Forecasting; Storms (Meteorology)

20020068017 NASA Marshall Space Flight Center, Huntsville, AL USA

A Lightning Channel Retrieval Algorithm for the North Alabama Lightning Mapping Array (LMA)

Koshak, William, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A new multi-station VHF time-of-arrival (TOA) antenna network is, at the time of this writing, coming on-line in Northern Alabama. The network, called the Lightning Mapping Array (LMA), employs GPS timing and detects VHF radiation from discrete segments (effectively point emitters) that comprise the channel of lightning strokes within cloud and ground flashes. The network will support on-going ground validation activities of the low Earth orbiting Lightning Imaging Sensor (LIS) satellite developed at NASA Marshall Space Flight Center (MSFC) in Huntsville, Alabama. It will also provide for many interesting and detailed studies of the distribution and evolution of thunderstorms and lightning in the Tennessee Valley, and will offer many interesting comparisons with other meteorological/geophysical wets associated with lightning and thunderstorms. In order to take full advantage of these benefits, it is essential that the LMA channel mapping accuracy (in both space and time) be fully characterized and optimized. In this study, a new revised channel mapping retrieval algorithm is introduced. The algorithm is an extension of earlier work provided in Koshak and Solakiewicz (1996) in the analysis of the NASA Kennedy Space Center (KSC) Lightning Detection and Ranging (LDAR) system. As in the 1996 study, direct algebraic solutions are obtained by inverting a simple linear system of equations, thereby making computer searches through a multi-dimensional parameter domain of a Chi-Squared function unnecessary. However, the new algorithm is developed completely in spherical Earth-centered coordinates (longitude, latitude, altitude), rather than in the (x, y, z) cartesian coordinates employed in the 1996 study. Hence, no mathematical transformations from (x, y, z) into spherical coordinates are required (such transformations involve more numerical error propagation, more computer program coding, and slightly more CPU computing time). The new algorithm also has a more realistic definition of source altitude that accounts for Earth oblateness (this can become important for sources that are hundreds of kilometers away from the network). In addition, the new algorithm is being applied to analyze computer simulated LMA datasets in order to obtain detailed location/time retrieval error maps for sources in and around the LMA network. These maps will provide a more comprehensive analysis of retrieval errors for LMA than the 1996 study did of LDAR retrieval errors. Finally, we note that the new algorithm can be applied to LDAR, and essentially any other multi-station TWA network that depends on direct line-of-site antenna excitation.

Author

Algorithms; Geophysics; Lightning; Imaging Techniques; Alabama; Mapping; Computerized Simulation

20020068019 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Horizontal Extent of Lightning Based on Altitude and Atmospheric Temperature

Vollmer, David R.; Mar. 26, 2002; 81p; In English

Report No.(s): AD-A404049; AFIT/GM/ENP/02M-10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Lightning poses a threat to aircraft in flight. to mitigate this threat, the U.S. Air Force requested a study of lightning distances. Three-Dimensional lightning data were examined for this study, spanning 1 March 1997 to 31 May 2001 and obtained from the Lightning Detection and Ranging System (LDAR) at the Kennedy Space Center, FL. The LDAR data points were first grouped into lightning flashes and branches using spatial and temporal criteria. Rawinsonde data were vertically interpolated to determine the temperature at the flash source point and each branch end point. The horizontal distance from flash sources to branch end was calculated. Percentiles of branch distance were examined as a function of altitude and temperature of the flash source and branch end points. The longest 99th percentile of branch distance (35 to 40 km) was found at 2 to 7 km altitude and between 10 and -20C. The altitude range of the longest branches remained similar by season, but the longest branches were found in the winter and spring

months, with summer and autumn distances shorter by 5 to 10 km. Summer results showed longer branch distances to the south and the winter data showed a significant elongation to the north.

DTIC

Lightning; Atmospheric Temperature; Temperature Profiles

20020068022 Air Force Inst. of Tech., School of Engineering and Management, Wright-Patterson AFB, OH USA

GPS-Derived Precipitable Water Compared with the Air Force Weather Agency's MM5 Model Output

Vollmer, Patricia A.; Mar. 26, 2002; 108p; In English; Original contains color images

Report No.(s): AD-A404058; AFIT/GM/ENP/02M-11; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Current moisture initialization sources lack the spatial and temporal resolution required for mesoscale moisture forecast accuracy critical for military operations. The Global Positioning System (GPS) satellite constellation provides an opportunity to extract accurate moisture observations based on the refraction of the GPS signal through the troposphere. GPS-derived precipitable water (PW) from two different research areas was independently compared with the Air Force Weather Agency's (AFWA's) MM5 PW model output. Results were concurrent with similar studies comparing GPS-derived PW with numerical weather models. The mean correlation in CONUS was 92.5%, while in Alaska it was 72.8%. Mean model biases were 1.22 mm in CONUS and 0.69 mm in Alaska. Mean RMSEs were 4.36 mm in CONUS and 2.76 mm in Alaska. In addition, comparisons were made between moist and dry locations, showing a 21.5% difference in correlation and a 17.8% difference in RMSE. The GPS network's superior temporal resolution captured the diurnal variations in PW, while the model consistently failed to take such variations into account as its forecast progressed. This seems it could be the largest source of error between the two data sets. A number of non-meteorological error sources exist that could impact use of GPS-derived PW in operational applications, such as terrain differences between the GPS receiver sites and the model interpolated heights. These error sources need to be further addressed prior to operational assimilation of this data into military weather models.

DTIC

Global Positioning System; Atmospheric Moisture

20020068082 Colorado State Univ., Office of Sponsored Research, Fort Collins, CO USA

Development and Implementation of a Statistical Typhoon Intensity Prediction Scheme for the Western North Pacific Final Report, 28 Dec. 2000-30 Jun. 2002

Knaff, John A.; Jun. 2002; 6p; In English

Contract(s)/Grant(s): N00014-01-1-0382

Report No.(s): AD-A404023; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary objective of this project was to create and implement a 5-day Statistical Typhoon Intensity Prediction Scheme (STIPS) into the operational suite of products available to JTWC. The development of such a scheme builds on the success of the Statistical Hurricane Intensity Prediction Scheme (SHIPS) developed for the Atlantic and Eastern North Pacific and used by the National Hurricane Center (DeMaria and Kaplan 1999). In the process of developing STIPS, a comprehensive statistical analysis is performed which identifies the physical processes associated with tropical cyclone intensification in this basin along with their relative importance. The resulting statistical scheme, STIPS produces tropical cyclone intensity forecasts along a specified forecast track. The STIPS model also has a companion formulation Decay-STIPS which factors in the effect of interaction with land and decays the forecasted intensity accordingly. A secondary objective was the development of simple 5-day statistical typhoon intensity forecast (STIFOR-5D) model which is based upon climatology and persistence (CLIPER). The development of this simple model was necessitated by the operational requirement to verify forecasts.

DTIC

Weather Forecasting; Typhoons; Prediction Analysis Techniques; Tropical Storms; Cyclones; Hurricanes

20020068090 Corps of Engineers, Washington, DC USA

Engineering and Design: Criteria for SPH and PMH Wind Fields

Mar. 20, 1981; 3p; In English

Report No.(s): AD-A404091; ER-1110-2-1453; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This regulation provides direction for the development of Standard Project Hurricane (SPH) and Probable Maximum Hurricane (PMH) wind fields along the gulf and east coasts of the USA.

DTIC

Records; Floods; Hurricanes

20020068098 NASA Marshall Space Flight Center, Huntsville, AL USA

Thunderstorms Characteristics Observed by TRMM

Goodman, Steven J., NASA Marshall Space Flight Center, USA; Cecil, Daniel J., Alabama Univ., USA; [2002]; 1p; In English; International Tropical Rainfall Measuring Mission (TRMM) Science Conference, 22-26 Jul. 2002, Honolulu, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The goal of the present study is to begin a more comprehensive examination of the spectrum of storm types and their attributes worldwide, and as a function of season, location, and convective regime using the observed lightning, microwave scattering, and reflectively signatures. A global, multi-year data set (1998-2000) is being assembled to further our understanding of convective processes in different climatological regimes. We find that the deepest thunderstorms (having reflectively in excess of 50 dBZ at 9 km altitude) occur in all the sub-tropical continents and occasionally over the open ocean. The most intense storms have the greatest lightning rates, lowest brightness temperatures and greatest depth of reflectively-all indicative of strong updrafts and a well-developed volume of precipitation-sized ice particles.

Author

Climatology; Ocean Surface; Thunderstorms; Trmm Satellite; Precipitation (Meteorology)

20020068904 Washington Univ., Applied Physics Lab., Seattle, WA USA

Evaluation of NOGAPS Forcing Data for PIPS 3.0 Final Report, 1 Oct. 1999-31 Mar. 2002

Schweiger, Axel J.; Jul. 19, 2002; 44p; In English; Original contains color images

Contract(s)/Grant(s): N00014-00-1-0073

Report No.(s): AD-A403908; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Operational requirements dictate the use of NOGAPS (Navy Operational Global Atmospheric Prediction System) forcing fields for the PIPS (Polar Ice Prediction System) ice forecasting system. This study provides an assessment of the NOGAPS model output as a suitable source for atmospheric forcing fields for PIPS 3.0. Included in the study is an assessment of the errors in some of the most critical model variables.

DTIC

Ice Formation; Atmospheric Models; Sea Ice; Weather Forecasting

20020068946 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mechanism of Torrential Rain Associated with the Mei-yu Development during SCSMEX-98

Qian, Jian-Hua, NASA Goddard Space Flight Center, USA; Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; Lau, K.-M., NASA Goddard Space Flight Center, USA; January 2002; 50p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A case of torrential precipitation process in the Mei-yu front, an Asian monsoon system east to the Tibetan Plateau, is studied with the coupled Penn State University/NCAR MM5 and NASA/GSFC PLACE (Parameterization for Land - Atmosphere - Cloud Exchange) models. Remote and local impacts of water vapor on the location and intensity of Mei-yu precipitation are studied by numerical experiments. Results demonstrate that the water vapor source for this heavy precipitation case in Yangtze river basin is derived mostly from the Bay of Bengal, transported by the southwesterly low-level Jet (LLJ) southeast to the Tibetan Plateau. The moist convection is a critical process in the development and maintenance of the front. The meridional and zonal secondary circulations resulted from Mei-yu condensation heating both act to increase the wind speed in the LLJ. The condensation induced local circulation strengthens the moisture transport in the LLJ, providing a positive feedback to sustain the Mei-yu precipitation system. It is found that local precipitation recycling shifts heavy rain toward the warm side of the Mei-yu front. This shift of rainfall location is due to the pronounced increase of atmospheric moisture and decrease of surface temperature over the warm side of the front.

Author

Jet Streams (Meteorology); Atmospheric Circulation; Atmospheric Moisture; Surface Temperature; Warm Fronts

20020068972 NASA Goddard Space Flight Center, Greenbelt, MD USA

High-Efficiency High-Resolution Global Model Developments at the NASA Goddard Data Assimilation Office

Lin, Shian-Jiann, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; CCSR Workshop, 4-8 Mar. 2002, Awaji Island, Tsukuba, Japan, Japan; Sponsored by Geothermal Research, Information and Planning Services Commission, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Data Assimilation Office (DAO) has been developing a new generation of ultra-high resolution General Circulation Model (GCM) that is suitable for 4-D data assimilation, numerical weather predictions, and climate simulations. These three applications have conflicting requirements. For 4-D data assimilation and weather predictions, it is highly desirable to run the

model at the highest possible spatial resolution (e.g., 55 km or finer) so as to be able to resolve and predict socially and economically important weather phenomena such as tropical cyclones, hurricanes, and severe winter storms. For climate change applications, the model simulations need to be carried out for decades, if not centuries. To reduce uncertainty in climate change assessments, the next generation model would also need to be run at a fine enough spatial resolution that can at least marginally simulate the effects of intense tropical cyclones. Scientific problems (e.g., parameterization of subgrid scale moist processes) aside, all three areas of application require the model's computational performance to be dramatically improved as compared to the previous generation. In this talk, I will present the current and future developments of the "finite-volume dynamical core" at the Data Assimilation Office. This dynamical core applies modern monotonicity preserving algorithms and is genuinely conservative by construction, not by an ad hoc fixer. The "discretization" of the conservation laws is purely local, which is clearly advantageous for resolving sharp gradient flow features. In addition, the local nature of the finite-volume discretization also has a significant advantage on distributed memory parallel computers. Together with a unique vertically Lagrangian control volume discretization that essentially reduces the dimension of the computational problem from three to two, the finite-volume dynamical core is very efficient, particularly at high resolutions. I will also present the computational design of the dynamical core using a hybrid distributed- shared memory programming paradigm that is portable to virtually any of today's high-end parallel super-computing clusters.

Author

Distributed Memory; Data Processing; Atmospheric General Circulation Models; Climate Change; Numerical Analysis

20020069105 Case Western Reserve Univ., Dept. of Civil Engineering, Cleveland, OH USA

Monitoring and Analysis of Data Obtained from Moisture Temperature Recording Stations *Final Report*

Figueroa, J. L.; Sep. 2001; 170p; In English

Report No.(s): PB2002-107481; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The performance of asphalt concrete pavements is in part affected by the seasonal variations of the resilient modulus of the AC layer and of the subgrade soil. To determine the variation of these parameters throughout Ohio, seven moisture-temperature-rainfall recording stations, previously installed during an Ohio Department of Transportation-funded project, and two additional ones installed during this project, were monitored for an additional period of 2-1/2 years. These stations, located to include various climatic zones and the four most common soil types within the state, recorded air, asphalt concrete and subgrade soil temperature, rainfall and moisture content (or degree of saturation) of the subgrade soil on a two-hour basis. Recorded data led to the development of polynomial equations to calculate the average asphalt concrete pavement temperature from the air temperature and to the division of the state into three temperature zones: Northern, Central and Southern. Recorded depths of frost penetration indicated average depths of 45 to 61 cm. within the southern zone and of 70 to 82 cm. within the northern zone. Similarly, the northern and the southern zones experience an average of 7 to 12 and 4 to 5 freeze-thaw cycles, respectively. The degree of saturation calculated from moisture and temperature sensor readings varied from about 90% to 100% throughout the monitoring period.

NTIS

Moisture Content; Temperature Sensors; Surface Temperature; Climatology

20020070204 NASA Goddard Space Flight Center, Greenbelt, MD USA

Impact of Mineral Aerosol on TOVS Temperature and Moisture Retrievals

Weaver, Clark, Maryland Univ. Baltimore County, USA; Joiner, Joanna, NASA Goddard Space Flight Center, USA; Ginoux, Paul, Georgia Tech Research Inst., USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Mineral aerosols can absorb significant radiation in the infrared spectrum. Consequently, there may be errors in TIROS Operational Vertical Sounder (TOVS) retrieved temperature and moisture profiles in regions of heavy dust loading. We first investigate the potential error in the temperature retrievals and secondly attempt to account for radiative effects of the dust in retrievals. Information on the dust concentrations and size distribution is from the Goddard Chemistry Aerosol Transport model (GOCART). Aerosol optical parameters are calculated from Mie scattering theory assuming a composition of pure illite. We used the cloud-clearing DAO TOVS retrieval system of Joiner and Rokke (2000). It is incorporated into the Data Assimilation Office (DAO) Finite Volume Data Assimilation System (NDAS). The advantage of this approach is that the first guess temperature profile used in the TOVS retrieval are forecasted temperatures from the previous assimilated time period. The operational DAO fvDAS was run for 10 days during June 2001 during a period of dust outbreaks off the coast of Africa over the Atlantic. The observed minus the forecast (O-F) brightness temperature at each TOVS channel is a measure of the accuracy of the retrieval. Since there was no account of dust during this operational run, a dependence of O-F on the estimated atmospheric dust concentrations from GOCART indicates that the dust is contaminating the TOVS retrievals. Channels that measure the surface

temperature, lower tropospheric temperature and moisture show this dependence. There are errors in the retrieved brightness temperature of a half a degree or more during heavy dust loading conditions. The forecasted brightness temperature is always greater than the observed value. The radiative transfer module used in the DAO TOVS retrieval system was modified to account for dust. We calculate the sensitivity of the brightness temperature of the TOVS channels to the dust concentrations in GOCART assuming pure illite. For most channels the observed relationship between O-F and dust concentrations in GOCART is consistent with these calculated sensitivities. The fvDAS run was repeated using the modified DAO TOVS retrieval system that accounts for dust. Preliminary results from this run show that there are significant effects on the retrieved surface temperature and tropospheric moisture.

Author

Atmospheric Composition; Aerosols; Atmospheric Models; Atmospheric Sounding; Tiros N Series Satellites; Atmospheric Moisture; Minerals

20020070295 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Investigation of the Influence of Urban Areas on Rainfall Using the TRMM Satellite and a Cloud-Mesoscale Model

Shepherd, J. Marshall, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A recent paper by Shepherd and Pierce (in press at Journal of Applied Meteorology) used rainfall data from the Precipitation Radar on NASA's Tropical Rainfall Measuring Mission's (TRMM) satellite to identify warm season rainfall anomalies downwind of major urban areas. Data (PR) were employed to identify warm season rainfall (1998-2000) patterns around Atlanta, Montgomery, Nashville, San Antonio, Waco, and Dallas. Results reveal an average increase of approx. 28% in monthly rainfall rates within 30-60 kilometers downwind of the metropolis with a modest increase of 5.6% over the metropolis. Portions of the downwind area exhibit increases as high as 51%. The percentage changes are relative to an upwind control area. It was also found that maximum rainfall rates in the downwind impact area exceeded the mean value in the upwind control area by 48%-116%. The maximum value was generally found at an average distance of 39 km from the edge of the urban center or 64 km from the center of the city. Results are consistent with METROMEX studies of St. Louis almost two decades ago and with more recent studies near Atlanta. A convective-mesoscale model with extensive land-surface processes is currently being employed to (a) determine if an urban heat island (UHI) thermal perturbation can induce a dynamic response to affect rainfall processes and (b) quantify the impact of the following three factors on the evolution of rainfall: (1) urban surface roughness, (2) magnitude of the UHI temperature anomaly, and (3) physical size of the UHI temperature anomaly. The sensitivity experiments are achieved by inserting a slab of land with urban properties (e.g. roughness length, albedo, thermal character) within a rural surface environment and varying the appropriate lower boundary condition parameters. The study will discuss the feasibility of utilizing satellite-based rainfall estimates for examining rainfall modification by urban areas on global scales and over longer time periods. The talk also introduces very preliminary results from the modeling component of the study. Such research has implications for weather forecasting, urban planning, water resource management, and understanding human impact on the environment and climate.

Author

Clouds (Meteorology); Earth Surface; Mesoscale Phenomena; Precipitation (Meteorology); Rain; Cities; Trmm Satellite

20020070384 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Investigation of the Influence of Urban Areas on Rainfall Using a Cloud-Mesoscale Model and TRMM Satellite

Shepherd, J. Marshall, NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; 4th AMS Conference on the Urban Environment, 20-24 May 2002, Norfolk, VA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The urban heat island (UHI) has become a widely acknowledged, observed, and researched phenomena because of its broad implications. It is estimated that by the year 2025, 80% of the world's population will live in cities (UNFP, 1999). The UHI has been documented in the literature to affect local and regional temperature distributions, wind patterns and air quality. The UHI can also impact the development of clouds and precipitation in and around cities. This paper will focus primarily on the UHI's impact on precipitation. In the past 30 years, several observational and climatological studies have theorized that the UHI can have a significant influence on mesoscale circulations and resulting precipitation (see Shepherd et al. 2002 for a thorough review). More recent studies have continued to validate and extend the findings from pre and post-METROMEX investigations. Shepherd et al. (2002) was one of the first (and possibly the first) attempts to identify rainfall modification by urban areas using satellite-based rainfall measurements. Using a 15-month (spanning three years) analysis of mean rainfall rates, the cities of Atlanta, Montgomery, Dallas, Waco, and San Antonio were examined. Shepherd et al. (2002) found that the average percentage increase in mean rainfall rate in a hypothesized "downwind maximum impact area" over an "upwind control area" was 28.4% with a range of 14.6 to 51%.

The typical distance of the downwind rainfall rate anomaly from the urban center was 30-60 km, consistent with earlier studies. This fact provides confidence that UHI-rainfall effects are real and detectable by TRMM satellite estimates.

Author

Atmospheric Models; Cities; Clouds (Meteorology); Heat Islands; Mesoscale Phenomena; Trmm Satellite; Rain

20020070562 NASA Goddard Space Flight Center, Greenbelt, MD USA

Scale Dependence of Statistics of Spatially Averaged Rain Rate Seen in TOGA COARE Comparison with Predictions from a Stochastic Model

Kundu, Prasun K., Maryland Univ. Baltimore County, USA; Bell, T. L., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A characteristic feature of rainfall statistics is that they in general depend on the space and time scales over which rain data are averaged. As a part of an earlier effort to determine the sampling error of satellite rain averages, a space-time model of rainfall statistics was developed to describe the statistics of gridded rain observed in GATE. The model allows one to compute the second moment statistics of space- and time-averaged rain rate which can be fitted to satellite or rain gauge data to determine the four model parameters appearing in the precipitation spectrum - an overall strength parameter, a characteristic length separating the long and short wavelength regimes and a characteristic relaxation time for decay of the autocorrelation of the instantaneous local rain rate and a certain 'fractal' power law exponent. For area-averaged instantaneous rain rate, this exponent governs the power law dependence of these statistics on the averaging length scale L predicted by the model in the limit of small L . In particular, the variance of rain rate averaged over an $L \times L$ area exhibits a power law singularity as $L \rightarrow 0$. In the present work the model is used to investigate how the statistics of area-averaged rain rate over the tropical Western Pacific measured with ship borne radar during TOGA COARE (Tropical Ocean Global Atmosphere Coupled Ocean Atmospheric Response Experiment) and gridded on a 2 km grid depends on the size of the spatial averaging scale. Good agreement is found between the data and predictions from the model over a wide range of averaging length scales.

Author

Rain; Stochastic Processes; Mathematical Models; Rates (Per Time)

20020070616 NASA Goddard Space Flight Center, Greenbelt, MD USA

On the Choice of Variable for Atmospheric Moisture Analysis

Dee, Dick P., NASA Goddard Space Flight Center, USA; DaSilva, Arlindo M., NASA Goddard Space Flight Center, USA; [2002]; 34p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The implications of using different control variables for the analysis of moisture observations in a global atmospheric data assimilation system are investigated. A moisture analysis based on either mixing ratio or specific humidity is prone to large extrapolation errors, due to the high variability in space and time of these parameters and to the difficulties in modeling their error covariances. Using the logarithm of specific humidity does not alleviate these problems, and has the further disadvantage that very dry background estimates cannot be effectively corrected by observations. Relative humidity is a better choice from a statistical point of view, because this field is spatially and temporally more coherent and error statistics are therefore easier to obtain. If, however, the analysis is designed to preserve relative humidity in the absence of moisture observations, then the analyzed specific humidity field depends entirely on analyzed temperature changes. If the model has a cool bias in the stratosphere this will lead to an unstable accumulation of excess moisture there. A pseudo-relative humidity can be defined by scaling the mixing ratio by the background saturation mixing ratio. A univariate pseudo-relative humidity analysis will preserve the specific humidity field in the absence of moisture observations. A pseudorelative humidity analysis is shown to be equivalent to a mixing ratio analysis with flow-dependent covariances. In the presence of multivariate (temperature-moisture) observations it produces analyzed relative humidity values that are nearly identical to those produced by a relative humidity analysis. Based on a time series analysis of radiosonde observed-minus-background differences it appears to be more justifiable to neglect specific humidity-temperature correlations (in a univariate pseudo-relative humidity analysis) than to neglect relative humidity-temperature correlations (in a univariate relative humidity analysis). A pseudo-relative humidity analysis is easily implemented in an existing moisture analysis system, by simply scaling observed-minus background moisture residuals prior to solving the analysis equation, and rescaling the analyzed increments afterward.

Author

Atmospheric Moisture; Humidity; Independent Variables; Analyzing

20020070660 Maryland Univ., Earth System Science Interdisciplinary Center, USA

Determining the Location and Radiative Impact of Thin Cirrus Clouds using Terra data

Dessler, A. E., Maryland Univ., USA; [2002]; 1p; In English; 2002 Spring AGU Meeting, 28-31 May 2001, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Thin cirrus clouds (with optical depth τ much less than 1) play a potentially important role in the Earth atmosphere. The Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Terra satellite has a channel at 1.375 microns that is specifically designed to detect these clouds. During two three-day periods from December 2000 and June 2001, I show that thin cirrus clouds are ubiquitous throughout the tropics. These thin cirrus generally have optical depths below 0.05 and appear with greater frequency and optical depth near deep convection. Regressing top-of-atmosphere outgoing longwave flux data from the Clouds and the Earth's Radiant Energy System (CERES) against optical depth, we calculate that these thin clouds decrease outgoing longwave flux by approx. 1 W/sq m/(0.01 τ). This translates into longwave forcing of several W/sq m near convection and zero away from convection. Averaging over the whole tropics, these thin cirrus decrease average longwave forcing is approx. 1.4 W/sq m.

Author

Cirrus Clouds; Optical Thickness; Convection; Flux (Rate)

48

OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

20020067739 NASA Marshall Space Flight Center, Huntsville, AL USA

Thermococcus sulfurophilus sp. nov., a New Hyperthermophilic, Sulfur-Reducing Archaeon Isolated from Deep-Sea Hydrothermal Vent

Pikuta, Elena V., Alabama Univ., USA; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Whitman, William B., Georgia Univ., USA; Marsic, Damien, Alabama Univ., USA; Garriott, Owen, Alabama Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A new hyperthermophilic, anaerobic, sulfur-reducing, organo-heterotrophic archaeon, strain OGL-20P, was isolated from "black smoker" chimney material at the Rainbow hydrothermal vent site in the Atlantic Ocean (36.2 N; 33.9 W). The cells of strain OGL-20P have irregular coccoid shape and are motile with a single flagellum. Growth occurs within pH range of 5.5-8.2 (optimal at pH 7.0-7.2), salinity range of 1-5% NaCl (optimal concentration 3% NaCl wt/vol), and temperature range of +55 C to +94 C (optimal growth at +83 C to +85 C). Strain OGL-20P is resistant to freezing (at -20 C). New isolate is strictly anaerobic with sulfur-type of respiration. A limited number of compounds are utilized as electron donors, including peptone, bacto-tryptone, casamino-acids, and yeast extract but does not grow with separate amino acids. Sulfur and Iron can be used as electron acceptors; but not sulfate, sulfite, thiosulfate or nitrate. Strain OGL-20P is resistant to chloramphenicol, kanamycin, and gentamycin. Growth of str. OGL20P is inhibited by tetracyclin but not by Na₂MoO₄. The G+C content of DNA is 57.2 mol%. The 16S ribosomal RNA sequence analysis allows one to classify strain OGL-20P as a representative of a new species of Thermococcus genus. The name Thermococcus sulfurophilus op. nov., was suggested for the new isolate, type strain OGL-20P (sup T) (= ATCC BAA_394 (sup T) = DSM...(supT)).

Author

Molecular Biology; Genetics; Amino Acids; Ocean Bottom; Anaerobes; Thermophiles; Sulfur

20020067796 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

Numerical Modeling of Swash Zone Hydrodynamics

Puleo, Jack; Holland, K. T.; Slinn, D.; Jun. 05, 2002; 3p; In English

Report No.(s): AD-A403978; NRL/PP/7440-02-1018; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The swash zone is the area of the nearshore that is intermittently covered and uncovered by wave run-up. Since swash hydrodynamics control the evolution of beach morphology, understanding these motions is of paramount importance. Typical studies of swash zone hydrodynamics involve the deployment of several instruments to measure the swash zone fluid velocity. While the Doppler devices have the ability to readily distinguish vertical flow structure, instrument deployment is necessarily

sparse due to cost and logistics. Recently a video-based remote sensing technique has also been developed that is capable of quantifying surface swash velocities over a fairly large spatial domain, but yields no information regarding subsurface flows.

DTIC

Mathematical Models; Hydrodynamics; Information Flow; Remote Sensing

20020068971 NASA Goddard Space Flight Center, Greenbelt, MD USA

Coastal Atmosphere and Sea Time Series (CoASTS)

Hooker, Stanford B., Editor, NASA Goddard Space Flight Center, USA; Firestone, Elaine R., Editor, Science Applications International Corp., USA; Berthon, Jean-Francoise, Joint Research Centre of the European Communities, Italy; Zibordi, Giuseppe, Joint Research Centre of the European Communities, Italy; Doyle, John P., Joint Research Centre of the European Communities, Italy; Grossi, Stefania, Joint Research Centre of the European Communities, Italy; vanderLinde, Dirk, Joint Research Centre of the European Communities, Italy; Targa, Cristina, Joint Research Centre of the European Communities, Italy; June 2002; 30p; In English

Report No.(s): NASA/TM-2002-206892/VOL20; Rept-2002-02646-0-VOL20; NAS 1.15:206892/VOL20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this document, the first three years of a time series of bio-optical marine and atmospheric measurements are presented and analyzed. These measurements were performed from an oceanographic tower in the northern Adriatic Sea within the framework of the Coastal Atmosphere and Sea Time Series (CoASTS) project, an ocean color calibration and validation activity. The data set collected includes spectral measurements of the in-water apparent (diffuse attenuation coefficient, reflectance, Q-factor, etc.) and inherent (absorption and scattering coefficients) optical properties, as well as the concentrations of the main optical components (pigment and suspended matter concentrations). Clear seasonal patterns are exhibited by the marine quantities on which an appreciable short-term variability (on the order of a half day to one day) is superimposed. This short-term variability is well correlated with the changes in salinity at the surface resulting from the southward transport of freshwater coming from the northern rivers. Concentrations of chlorophyll alpha and total suspended matter span more than two orders of magnitude. The bio-optical characteristics of the measurement site pertain to both Case-I (about 64%) and Case-II (about 36%) waters, based on a relationship between the beam attenuation coefficient at 660nm and the chlorophyll alpha concentration. Empirical algorithms relating in-water remote sensing reflectance ratios and optical components or properties of interest (chlorophyll alpha, total suspended matter, and the diffuse attenuation coefficient) are presented.

Author

Time Series Analysis; Ocean Data Acquisitions Systems; Water Color; Marine Meteorology; Chlorophylls; Oceanography

20020069012 NASA Goddard Space Flight Center, Greenbelt, MD USA

Coastal Atmosphere and Sea Time Series (CoASTS)

Hooker, Stanford B., Editor, NASA Goddard Space Flight Center, USA; Firestone, Elaine R., Editor, Science Applications International Corp., USA; Zibordi, Giuseppe, Joint Research Centre of the European Communities, Italy; Berthon, Jean-Francoise, Joint Research Centre of the European Communities, Italy; Doyle, John P., Joint Research Centre of the European Communities, Italy; Grossi, Stefania, Joint Research Centre of the European Communities, Italy; vanderLinde, Dirk, Joint Research Centre of the European Communities, Italy; Targa, Cristina, Joint Research Centre of the European Communities, Italy; Alberotanza, Luigi, Consiglio Nazionale delle Ricerche, Italy; June 2002; 34p; In English

Report No.(s): NASA/TM-2002-206892/VOL19; Rept-2002-02645-0/VOL19; NAS 1.15:206892/VOL19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Coastal Atmosphere and Sea Time Series (CoASTS) Project aimed at supporting ocean color research and applications, from 1995 up to the time of publication of this document, has ensured the collection of a comprehensive atmospheric and marine data set from an oceanographic tower located in the northern Adriatic Sea. The instruments and the measurement methodologies used to gather quantities relevant for bio-optical modeling and for the calibration and validation of ocean color sensors, are described. Particular emphasis is placed on four items: (1) the evaluation of perturbation effects in radiometric data (i.e., tower-shading, instrument self-shading, and bottom effects); (2) the intercomparison of seawater absorption coefficients from in situ measurements and from laboratory spectrometric analysis on discrete samples; (3) the intercomparison of two filter techniques for in vivo measurement of particulate absorption coefficients; and (4) the analysis of repeatability and reproducibility of the most relevant laboratory measurements carried out on seawater samples (i.e., particulate and yellow substance absorption coefficients, and pigment and total suspended matter concentrations). Sample data are also presented and discussed to illustrate

the typical features characterizing the CoASTS measurement site in view of supporting the suitability of the CoASTS data set for bio-optical modeling and ocean color calibration and validation.

Author

Time Series Analysis; Oceanography; Water Color; Data Acquisition; Ocean Data Acquisitions Systems

20020070385 NASA Goddard Space Flight Center, Greenbelt, MD USA

Airborne Spectral Measurements of Ocean Anisotropy during CLAMS

Gatebe, C. K., Maryland Univ. Baltimore County, USA; King, M. D., NASA Goddard Space Flight Center, USA; Arnold, G. T., Emergent Information Technologies, Inc., USA; [2002]; 1p; In English; 2002 American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Cloud Absorption Radiometer (CAR) aboard the University of Washington Convair CV-580 research aircraft obtained bidirectional reflectance-distribution function (BRDF) of Atlantic Ocean and Dismal Swamp between July 10 and August 2, 2001. The BRDF measurements (15 in total, 8 uncontaminated by clouds) obtained under a variety of sun angles and wind conditions, will be used to characterize ocean anisotropy in support of Chesapeake Lighthouse and Aircraft Measurements for Satellites (CLAMS) science objectives principally to validate products from NASA's EOS satellites, and to parameterize and validate BRDF models of the ocean. In this paper we present results of BRDF of the Ocean under different sun angles and wind conditions. The CAR is capable of measuring scattered light in fourteen spectral bands. The scan mirror, rotating at 100 rpm, directs the light into a Dall-Kirkham telescope where the beam is split into nine paths. Eight light beams pass through beam splitters, dichroics, and lenses to individual detectors (0.34-1.27 micron), and finally are registered by eight data channels. They are sampled simultaneously and continuously. The ninth beam passes through a spinning filter wheel to an InSb detector cooled by a Stirling cycle cooler. Signals registered by the ninth data channel are selected from among six spectral channels (1.55-2.30 micron). The filter wheel can either cycle through all six spectral bands at a prescribed interval (usually changing filter every fifth scan line), or lock onto any one of the six spectral bands and sample it continuously. to measure the BRDF of the surface-atmosphere system, the University of Washington CV-580 had to fly in a circle about 3 km in diameter above the surface for roughly two minutes. Replicated observations (multiple circular orbits) were acquired over selected surfaces so that average BRDF smooth out small-scale surface and atmospheric inhomogeneities. At an altitude of 600 m above the targeted surface area and with a 1 degree IFOV, the pixel resolution is about 10 m at nadir and about 270 m at an 80 deg. viewing angle from the CAR.

Author

Airborne Equipment; Anisotropy; Ocean Models; Spectrum Analysis; Bidirectional Reflectance; Research Aircraft; Clouds (Meteorology)

20020070651 NASA Goddard Space Flight Center, Greenbelt, MD USA

Comparisons of Satellite Retrieval of Aerosol Properties from SeaWiFS and TOMS to the AERONET Measurements during ACE-Asia

Hsu, Christina N., Maryland Univ. Baltimore County, USA; Tsay, Si-Chee, NASA Goddard Space Flight Center, USA; Herman, R., NASA Goddard Space Flight Center, USA; Holben, Brent, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The primary goal of the ACE (Aerosol Characterization Experiment)-Asia mission is to increase our understanding of how atmospheric aerosol particles over the Asian-Pacific region affect the Earth climate system. In support of the day-to-day flight planning of ACE-Asia, we built a near real-time system to provide satellite data from the polar-orbiting instruments Earth Probe TOMS (Total Ozone Mapping Spectrometer) (in the form of absorbing aerosol index) and SeaWiFS (Sea-Viewing Wide Field-of-View Sensor) (in the form of aerosol optical thickness and Angstrom exponent). The results were available via web access. These satellite data provide a 'big picture' of aerosol distribution in the region, which is complementary to the ground based measurements. In this paper, we will briefly discuss the algorithms used to generate these data. The retrieved aerosol optical thickness and Angstrom exponent from SeaWiFS will be compared with those obtained from various AERONET (Aerosol Robotic Network) sites over the Asian-Pacific region. The TOMS aerosol index will also be compared with AERONET aerosol optical thickness over different aerosol conditions. Finally, we will discuss the climate implication of our studies using the combined satellite and AERONET observations.

Author

Aerosols; Algorithms; Optical Thickness; Earth Atmosphere; Climate

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20020067719 RAND Corp., Santa Monica, CA USA

Improving Childhood Asthma Outcomes in the USA. A Blueprint for Policy Action

Lara, Marielena; Nicholas, Will; Morton, Sally; Vaiana, Mary E.; Genovese, Barbara; Jan. 2001; 118p; In English
Report No.(s): AD-A403849; RAND/MR-1330; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Almost everyone knows a child with asthma. Although asthma is a treatable disease, too many children with asthma suffer unnecessarily. Some even die. Yet children whose asthma is properly controlled can lead fully active lives, with minimal symptoms. The number of persons with asthma in the USA has doubled in the past 15 years. Children are the most affected: An estimated 5 million children under 15 years old have this disease. The cases of asthma in children under 5 years old increased more than 160 percent between 1980 and 1994. For children ages 5 to 14, the increase was 74 percent. Asthma is more common among children who are poor, African American, or Puerto Rican. The disease has serious economic consequences. Asthma cost an estimated \$10.7 billion in 1994---more than half of it for direct medical expenses, the rest for indirect costs associated with school and work days lost, as well as with premature mortality. A significant portion of the medical expenses was for tertiary care, such as hospitalizations and emergency room visits. Medical care for asthma has improved significantly. Effective primary care can help children with asthma to lead fully functional lives and prevent costly hospitalizations. Yet the human and financial costs of childhood asthma continue to grow.

DTIC

Children; Asthma; Diseases

20020067721 Miami Univ., FL USA

A Novel Signaling Perturbation and Ribozyme Gene Therapy Procedure to Block Rho-Kinase (ROK) Activation and Breast Tumor Metastasis Annual Report, 1 Sep. 2000-31 Aug. 2001

Bourguignon, Lilly Y.; Sep. 2001; 39p; In English

Contract(s)/Grant(s): DAMD17-99-1-9291

Report No.(s): AD-A403860; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Breast tumor cells (SP- 1) express a major cell adhesion molecule, CD44v 10, which binds the extracellular matrix component, hyaluronan (HA), at its external domain and interacts with various signaling molecules at its cytoplasmic domain. In this study we have determined that CD44v10 and Rho-Kinase (ROK) are physically associated as a complex in vivo. Using a recombinant fragment of ROK in particular, the pleckstrin homology (PH) domain and in vitro binding assays, we have detected a specific binding interaction between the PH domain of ROK and the cytoplasmic domain of CD44. Scatchard plot analysis indicates that there is a single high affinity CD44 binding site in the PH domain of ROK with an apparent dissociation constant (Kd) of 1.76nM which is comparable to CD44 binding (Kd 1.56nM) to intact ROK. These findings suggest that the PH domain is the primary ROK binding region for CD44. Furthermore, HA binding to SP- 1 cells promotes RhoA-mediated ROK activity which, in turn, increases phosphorylation of three different inositol 1, 4, 5-trisphosphate receptors (IP3Rs) IN PARTICULAR, SUBTYPE 1 (LP3R1), and to a lesser extent subtype 2 (1P3R2) and subtype 3 (1P3R3) all known as 1P3-gated Ca²⁺ channels. The phosphorylated IP3R1 (but not 1P3R2 and 1P3R3) is enhanced in its binding to 1P3 which subsequently stimulates 1P3-mediated Ca²⁺ flux. Transfection of SP- 1 cells with ROK's PH cDNA significantly reduces ROK association with CD44v 10, and effectively inhibits ROK-mediated phosphorylation of IP3Rs and IP3R-mediated Ca²⁺ flux in vitro. The PH domain of ROK also functions as a dominant-negative mutant in vivo to block HA-dependent, CD44v10-specific intracellular Ca²⁺ mobilization and breast tumor cell migration. Taken together, we believe that CD44v 10 interaction with ROK plays a pivotal role in IP3R-mediated Ca²⁺ signaling during HA-mediated breast tumor cell migration.

DTIC

Metastasis; Cells (Biology); Enzyme Activity; Phosphorylation; Homology

20020067737 NASA Marshall Space Flight Center, Huntsville, AL USA

Tindallia Californiensis sp. nov.: A New Halo-Alkaliphilic Primary Anaerobe, Isolated from Meromictic soda Mono Lake in California and the Correction of Diagnosis for Genus Tindallia

Pikuta, Elena, Alabama Univ., USA; Marsic, Damien, Alabama Univ., USA; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Kevbrin, Vadim, Georgia Univ., USA; Whitman, William B., Georgia Univ., USA; Krader, Paul, ATCC, USA;

Cleland, Dave, ATCC, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A novel extremely halo-alkaliphilic, bacterium strain APO (sup T) was isolated from sediments of the athalassic, meromictic, soda Mono Lake in California. Gram positive, spore-forming, slightly curved rods with sizes 0.6-0.7x 2.5-4.0 micrometers which occur singly, in pairs or short curved chains. Cells, are motile by singular subcentral flagellum. Strain APO (sup T) is mesophilic: growth was observed over the temperature range of +10 C to +48 C (optimum +37 C), NaCl concentration range 1-20 %, wt/vol (optimum 3-5%, wt/vol) and pH range 8.0-11.0 (optimum pH 9.5). The novel isolate is strictly halo-alkaliphilic, requires sodium chloride in medium, obligately anaerobic and catalase-negative. Strain APO (sup T) is organo-heterotroph with fermentative type of metabolism, and uses as substrates: peptone, badotryptone, casamino acids, yeast extract, L-serine, L-lysine, L-histidine, L-arginine, and pyruvate. The main end products of growth on peptone medium were: lactate, acetate, propionate, and ethanol. Strain APO (sup T) is resistant to kanamycin, but sensitive to chloramphenicol, tetracycline, and gentamycin. The sum of G+C in DNA is 44.4 mol% (by HPLC method). On the bait of physiological and molecular properties, the isolate was considered as novel species of genus Tindallia; and the name Tindallia californiensis sp. nov., is proposed for new isolate (type strain APO (sup T) - ATCC BAA_393(sup T) = DSMZ 14871 (sup T)).

Author

Anaerobes; Antibiotics; Heterotrophs; Lakes; Liquid Chromatography; California; Bacteria; Genetics

20020067749 Stanford Univ., Stanford, CA USA

The Development and Evaluation of an Innovative Internet-Based Breast Cancer Psychosocial Intervention Annual Report, 1 Oct. 2000-30 Sep. 2001

Taylor, C. B.; Winzelberg, Andrew J.; Oct. 2001; 13p; In English

Contract(s)/Grant(s): DAMD17-99-1-9387

Report No.(s): AD-A403662; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project is to develop and evaluate an Internet-based psychosocial intervention for women with primary breast cancer. During this funding period (10/1/00 to 9/31/01), the following tasks were completed: (1) 72 women were randomized to usual care (wait-list control group) or psychosocial support group. Three twelve-week Internet-based psychosocial groups (8-12 members per group) were facilitated with intervention group participants and two groups were facilitated with wait-list control group participants; (2) preliminary analyses on data collected from participants were completed; (3) preliminary text analyses of the support group messages were completed. Results: The initial analyses found that in comparison to wait-list control group participants, intervention group participants significantly reduced their depression, post-traumatic stress, and general stress scores. Significance: Women with primary breast cancer are able to participate in Internet-based psychosocial interventions and receive substantial benefits from their participation. The next phase of the project will be to complete enrollment into the intervention, analyze completed outcome data, and continue our exploration of ways to capture and understand the discourse that occurred in the groups.

DTIC

Cancer; Mammary Glands; Stress (Psychology); Internets; Sociology

20020067755 Army Command and General Staff Coll., School of Advanced Military Studies, Fort Leavenworth, KS USA

Force Health Protection for the Objective Force

Dingle, Raymond S.; Apr. 26, 2002; 52p; In English; Original contains color images

Report No.(s): AD-A403784; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The transformation of the U.S. Army from a 2002 legacy force, into the future Objective Force will create unique challenges for the medical sustainment mission. As new methods and concepts are introduced that capitalize on information technologies and enhanced productivity, the Army Medical Department will seek parity in operational capabilities. This is not an easy task, as constraints to reduce the sustainment organization and operate within an extended contemporary operating environment will challenge the capability to provide medical sustainment. If the medical sustainment footprint is reduced, the capability to 'Conserve the Fighting Strength' of the Objective Force soldier in the contemporary operating environment will be at risk. The Army Medical Department (AMEDD) has the responsibility of transforming the U.S. Army's Combat Health Support system into a seamless continuum that will sustain the life of the Objective Force in a complex contemporary operating environment. The future medical sustainment concept is called Force Health Protection. The AMEDD provides support at any cost, however, can it adequately support a force that is more mobile, dominant, and faster than any peer competitor? In comparison, the Combat Health Support unit is a step behind the fighting force in regards to equipment, capability, and mobility. The advent of the Objective Force has the potential to widen the gap between the fighting force and it's supporting Combat Health Support system. The Objective Force is the future combat force that will operate throughout the full spectrum of military operations. It will possess dominant maneuver, lethality, speed, and the technological advantage as it operates over extended distances. As military leaders

demand a smaller and more mobile force, the Force Health Protection of the Objective Force soldier will require leap ahead medical technologies and innovations to support the force.

DTIC

Medical Services; Health

20020068380 Tufts Univ., School of Medicine, Boston, MA USA

Structure of the Phage T4 Tail Fiber Angle Final Report, 15 Jul. 1998-30 Sep. 2000

Goldberg, Edward; Jul. 01, 2002; 8p; In English

Contract(s)/Grant(s): N00014-98-1-0784

Report No.(s): AD-A403938; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our goal is to form a polygonal nanospring by self-assembly, from a designed strut-like chimeric protein. This protein is made from fragments of the T4 tail fiber and binds specifically to its angle protein. We have designed and expressed this chimeric protein which will inhibit the burst size of a T4 infected bacterium. This indicates that the chimeric protein can fold and oligomerize to create a site that binds tightly enough to the angle protein to sequester it and thereby greatly reduce the phage burst size.

DTIC

Proteins; Self Assembly; Bacteriophages

20020068795 Spelman Coll., Dept. of Biology, Atlanta, GA USA

Cancer Risk-Assessment of Radiation Damage in Ataxia Telangiectasia Heterozygous Human Breast Epithelial Cell Cultures

Applewhite, Lisa C., Spelman Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. III-1 - III-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes the study of the markers of cellular changes that are found during the onset of carcinogenesis. Several of the biological factors are markers of stress response, oncoprotein expression, and differentiation factors. Oxidative stress response agents such as heat shock proteins (HSPs) protect cells from oxidative stresses such as ionizing radiation. The oncoprotein HER-2/neu, a specific breast cancer marker, indicates early onset of cancer. Additional structural and morphogenetic markers of differentiation were considered in order to determine initial cellular changes at the initial onset of cancer. As an additional consideration, all-trans retinoic acid (RA), a differentiation agent, was considered because of its known role in regulating normal differentiation and inhibiting tumor proliferation via specific nuclear receptors. This paper discusses study and results of the preliminary analyses of gamma irradiation of AT heterozygous human breast epithelial cells (WH). Comparisons are also made of the effects various RA concentrations post-irradiation.

Derived from text

Genes; Cancer; Mammary Glands; Radiation Effects

20020068901 Walter Reed Army Inst. of Research, Div. of Pathology, Washington, DC USA

Global Gene Analysis of Various Biological Threat and Infectious Agents Using PBMC: Implications for Therapy and Rapid Diagnostics Final Report

Das, Rina; Cummings, Christiano; Mendis, Chanaka; Hoover, David; Lindler, Luther; Jan. 2001; 10p; In English; Original contains color images

Report No.(s): AD-A403920; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Concerns relating to unidentifiable pathogens that could result from either deliberate or natural mutation processes have prompted studies to find alternative approaches other than the conventional detection methods. Our thesis was that an exposed individual would show gene expression responses unique to the pathogenic agent and prior to onset of the full illness. This study describes our work to establish a library of host responses to pathogenic agents for use to: (a) identify biological threat agents (b) predict the course of impending illness especially for unidentifiable pathogens (c) reveal new therapeutic targets. We demonstrate gene expression profiles unique to each pathogenic agent. The gene expression profiles of some agents preceded symptoms of impending illness.

DTIC

Genetics; Biological Weapons; Diagnosis; Therapy

20020068907 Occupational Safety and Health Administration, Washington, DC USA

Screening and Surveillance: A Guide to OSHA Standards

Herman, Alexis M.; Jeffress, Charles N.; Jan. 2000; 33p; In English

Report No.(s): AD-A403898; OSHA-3162; No Copyright; Avail: CASI; A03, Hardcopy

The Occupational Safety and Health Administration (OSHA) receives many inquiries about the "medical surveillance" provisions of its standards. This guide is a quick reference to help you locate and implement the screening and surveillance requirements of the OSHA standards in Title 29 of Code of Federal Regulations (29 CFR). The guide provides a general overview of OSHA requirements, but is not a legal authority for compliance with them. For full details of specific compliance requirements, please consult the appropriate OSHA standard in the CFR. You can access the medical surveillance provisions of the OSHA standards on the Internet at www.osha.gov.

DTIC

Public Health; Regulations; Industrial Management

20020068983 NASA Ames Research Center, Moffett Field, CA USA

The Role of Cyanobacteria in Stromatolite Morphogenesis, Highborn Cay Bahamas: An Integrated Field and Laboratory Simulation Study

Prufert-Bebout, Leslie, NASA Ames Research Center, USA; Shepard, Rebekah, Oberlin Coll., USA; Reid, Pamela R., Miami Univ., USA; Oct. 24, 2001; 1p; In English; Geological Society of America Conference, 1-10 Nov. 2001, Boston, MA, USA; Sponsored by Geological Society of America, USA

Contract(s)/Grant(s): RTOP 344-42-02-08; No Copyright; Avail: Issuing Activity; Abstract Only

Geomicrobiological phenomena are among the most fundamental of interactions between Earth and its biosphere. Actively growing and lithifying stromatolites at Highborne Cay Bahamas, have recently been documented and allow for detailed examination of the roles microbes play in the mineralization process. These stromatolites contain a variety of complex microbial communities with distinct distribution patterns for different microbial groups. Cyanobacteria are the primary producers in this system providing energy, directly or indirectly, for the entire stromatolite microbial community. They also play key roles in the trapping and binding of sediments. Most of these species are highly motile and can adjust their position and orientation within the sediment matrix in order to optimize their access to irradiance and nutrients. As individual species have different physical and metabolic properties, this motility generally results in segregated distributions of species, which in turn contributes to the laminated textures observed in these actively forming stromatolites. Increasingly our studies suggest that the activities and locations of various cyanobacterial species also contribute greatly to the localization of new mineral precipitation through a variety of processes. We are investigating these contributions using an integrated approach combining detailed observations of field samples with manipulative experiments using both field samples and cultures of specific organisms isolated from these stromatolites. Experiments are conducted both in standard laboratory conditions and in outdoor running seawater flumes. A variety of standard techniques; SEM (scanning electron microscopy), petrographic analyses, TEM (transmission electron microscopy), are used to compare mineralization processes in field samples with those generated in laboratory-flume simulations. Using this approach we are able to more thoroughly investigate the effects of irradiance, CaCO₃ saturation, and hydrodynamic regime on cyanobacterial distribution, trapping and binding and mineral precipitation. Simulation results will be presented and compared with community and mineralization distribution patterns seen in the field samples from which these communities were isolated.

Author

Bacteria; Petrogenesis; Metabolism; Biogeochemistry

20020069114 NASA Ames Research Center, Moffett Field, CA USA

Skeletal Phenotype of Transgenic Mice Expressing the Beta1 Integrin Cytoplasmic Tail In Osteoblasts

Globus, R. K., NASA Ames Research Center, USA; vanderMeulen, M. C. H., Cornell Univ., USA; Damsky, D., California Univ., USA; Kim, J.-B., California Univ., USA; Amblard, D., NASA Ames Research Center, USA; Amblard, D., NASA Ames Research Center, USA; Nishimura, Y., NASA Ames Research Center, USA; Almeida, E., NASA Ames Research Center, USA; Iwaniec, U. T., Florida State Univ., USA; Wronski, T. J., Florida State Univ., USA; Sep. 02, 2002; 1p; In English; American Society for Bone and Mineral Research, 20-24 Sep. 2002, San Antonio, TX, USA

Contract(s)/Grant(s): 99-HEDS-02/03-062; No Copyright; Avail: Issuing Activity; Abstract Only

To define the physiologic role of beta1 integrin in bone formation and mechanical loading, transgenic mice were generated by expressing the cytoplasmic tail and transmembrane domain of Beta1 integrin under the control of the osteocalcin promoter. In cultured cells, this truncated fragment of Beta1 can act as a dominant negative. Previously, the matrix of calvariae was shown to be abnormal in transgenic (TG) compared to wildtype (WT) mice. In this study, we analyzed appendicular bone in TG and WT, male and female mice at 14, 35, 63, 90 and 365 days old (n=8-12/gp). to assess beta1 integrin function in mechanical loading, a pilot study using hindlimb unloading by tail suspension was performed. 35d old TG and WT females were hindlimb unloaded for 4 wks (n=3-5). Body mass, bone mineral content, histomorphometric (distal femur) and biomechanical parameters were analyzed. Statistical significance (P less than .05) was defined by ANOVA using the Tukey-Kramer post-hoc test. We confirmed

transgene expression by immunoprecipitating then immunoblotting bone lysates using an antibody against the beta1 tail. Body masses of TG mice at 63, 90 and 365d old were greater (16-25%) than WT. Some TG female mice at 365d appeared obese; mean abdominal fat mass was 415% greater in TG than WT mice. Tibiae were longer (5-7%) in TG than WT mice at 63 and 90d. Tibial mineral mass of 35d males was 7% lower in TG than WT mice, but at 63d was 21% higher. The % osteoblast surface in 35d TG mice was 20% higher than WT, and at 63d was 17% lower, while % osteoclast surface did not differ. In 365d mice, cancellous bone volume (125%) and endocortical mineral apposition rate (40%) were greater in TG than WT males but not females. In WT mice, hindlimb unloading caused a reduction in mineral mass of tibiae (-20%) and lumbar vertebrae (-22%) relative to normally loaded controls. Surprisingly, hindlimb unloading also caused a relative reduction (-13%) in humerus mass. The effects of hindlimb unloading on tibia and humerus mass were less obvious in TG than in WT mice. Since hindlimb unloading caused skeletal changes in both loaded and unloaded bones, systemic changes may contribute to bone responses observed using this animal model. In conclusion, transgene expression resulted in marked metabolic changes during growth and in the aged female. Our results demonstrate that expression of the Beta1 integrin cytoplasmic tail in vivo causes gender- and age-specific changes in select morphometric parameters, bone length, and bone mass.

Author

Hindlimb Suspension; Osteoblasts; Physiology; Cytoplasm; Musculoskeletal System; Gene Expression

20020069135 NASA Ames Research Center, Moffett Field, CA USA

Body Composition of Rats on NASA Rodent Foodbar Versus Purina Lab Chow

Yu, Diane Sau Mun, Lockheed Martin Corp., USA; Dalton, Bonnie P., NASA Ames Research Center, USA; Barrett, Joyce E., Lockheed Martin Corp., USA; Apr. 01, 2002; 1p; In English; Federation of American Societies for Experimental Biology, 23 Apr. 2002, New Orleans, LA, USA

Contract(s)/Grant(s): RTOP 393-25-00; No Copyright; Avail: Issuing Activity; Abstract Only

The objective of this study is to test the nutritional adequacy of the NASA Rodent Foodbar for long term use for rats. The Foodbar was tested on two rat strains, Sprague Dawley and Fischer 344. Rats were fed either Foodbar or the control diet, Purina Chow #5012. Body composition analysis was performed on a selected number of samples (n=6 for each gender and treatment group) as part of extensive testing of the Foodbar. Water, fat, ash, and protein (and their percentages) for both treatment groups were compared. Sprague Dawley Foodbar fed rats had a lower % protein than Chow fed rats (25.8% vs. 30.0%). In addition, Sprague Dawley females fed Foodbar had higher total fat (42.1g vs. 24.6g) and % fat (16.4% vs. 10.5%), but lower % water (51.3% vs. 54.8%) than Sprague Dawley females fed Chow. Fischer 344 Foodbar fed rats had a lower % water (47.4% vs. 49.3%) and total water (93.2g vs. 99.6g). In addition, Fischer 344 Foodbar males had higher % fat (17.0% vs. 13.8%) and total fat (43.0g vs. 34.7g). The data suggests that body composition of Foodbar fed rats tends to have lower water content but a higher fat content compared to controls, but not all results are the same for different strains and even different genders within the same strains. The data obtained here, in addition to other data, helps provide a better understanding of the nutritional adequacy of the Foodbar and whether the formula may need to be modified.

Author

Rodents; Food; Body Composition (Biology); Diets

20020070672 Federal Motor Carrier Safety Administration, Washington , DC USA

Impact of Sleeper Berth Usage on Driver Fatigue Final Report

Jul. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM Report No.(s): PB2002-107930; FMCSA-RT-02-050; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this project was to assess the impact that sleeper berth usage has on operator alertness. Forty-seven males and nine females participated in this study, constituting 13 teams and 30 single drivers. All drivers who participated in this study were recruited from one of four for-hire commercial trucking companies. Two tractors, a 1997 Volvo L4 VN-series tractor and a 1995 Peterbilt 379, with functionally identical instrumentation packages and data collection systems, were used for the study. The data acquisition system functioned to record four camera views, including the drivers face; driving performance information, including steering, lane departure, and braking; sleeper berth environmental data, including noise, vibration, and temperature; subjective alertness ratings; and data from the Nightcap sleep-monitoring system. The following results were obtained: (1) Sleeping in either a stationary or moving sleeper berth was shown to adversely affect sleep quality and quantity when compared to the home sleep data. This was particularly true for team drivers in moving trucks. (2) Team drivers generally acquired more sleep (greater than one hour per day on average) than did single drivers, with single drivers reporting six hours of sleep per 24-hour period and team drivers reporting just over seven hours per 24-hour period. (3) Team drivers had significantly more sleep disturbances than did single drivers. A primary cause of these disturbances appeared to be noise and vibration present in the sleeper berth of a moving truck. (4) In general, single drivers were rated as not drowsy more often and team drivers, who were rated as somewhat drowsy

or moderately drowsy more often. However, of the 20 very/extremely drowsy episodes captured by Observer Ratings of Drowsiness, 16 were from single drivers. (5) Single drivers had many more critical incidents at all levels of severity relative to team drivers. (6) The frequency of critical incidents and driver errors varied significantly by the Hour of Day. However, many more incidents occurred during the afternoon and early evening as opposed to late at night. (7) Single drivers were more alert in the morning and gradually become fatigued during the day, whereas team drivers maintained a relatively constant level of alertness throughout the 24-hour clock.

NTIS

Sleep Deprivation; Data Acquisition; Noise Temperature; Performance Tests

52

AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20020067712 Institute for Human Factors TNO, Soesterberg, Netherlands

A Focus on Motion Sickness Regarding the 1997 NATO Performance Assessment Questionnaire (PAQ) Data Final Report Een Nadere Beschouwing van de 1997 NATO "Performance Assessment Questionnaire" (PAQ) Data Met Betrekking Tot Bewegingsziekte

Bos, J. E., Institute for Human Factors TNO, Netherlands; Colwell, J. L., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Mar. 28, 2002; 44p; In English; Original contains color illustrations

Contract(s)/Grant(s): 013.21332; TNO Proj. 789.3

Report No.(s): TD-2001-0374; TM-02-A017; Copyright; Avail: Issuing Activity

The performance assessment questionnaire (PAQ) was deployed in 1997 on seven ships operating in a typical NATO combat exercise. Among many other things, this PAQ gave data on crew performance, motion sickness and the use of anti motion sickness medication. Within the framework of the ABCD Working Group on Human Performance at Sea these data were distributed among its members. We re-analyzed these data focusing on motion sickness items. Methods: Based on common sense, we grouped part of these data into one binary objectively verifiable fall factor indicating whether or not a task was completed within the intended time. Sickness ratings were tested against this fall factor. Results: The effect that more failures were present in crew suffering from seasickness was highly significant, indicating the importance of seasickness with respect to the mission performance. Within the PAQ, sickness has been rated by different questions. Based on this reanalysis, we conclude that the PAQ-MISC (a rating based on a sad, a neutral and a happy looking face) or the TNO-MISC (a rating with an explicit reference to certain sickness symptoms), can be used instead of the list of sickness related PAQ questions. This would considerably facilitate further use of the PAQ. The risk of mission failure was shown to increase dramatically with increasing sickness aboard ships. Lastly, it is shown that the use of and motion sickness medication does not improve task performance. But, to analyze the cause-effect relationships, more (i.e. other) data would be needed, and it is recommended to study these effects in future trials. Conclusions: The relation between sickness severity and mission performance could and has been quantified, indicating that with decreasing crew numbers motion sickness may become an unacceptable threat to the mission performance, and therefore deserves special attention.

Author

Human Performance; Mathematical Models; Surveys; Motion Sickness; Tasks; Physiological Factors

20020068899 NASA Ames Research Center, Moffett Field, CA USA

Cardiopulmonary Responses to Supine Cycling during Short-Arm Centrifugation

Vener, J. M., Utah Univ., USA; Simonson, S. R., NASA Ames Research Center, USA; Stocks, J., NASA Ames Research Center, USA; Evettes, S., NASA Ames Research Center, USA; Bailey, K., NASA Ames Research Center, USA; Biagini, H., NASA Ames Research Center, USA; Jackson, C. G. R., California State Univ., USA; Greenleaf, J. E., NASA Ames Research Center, USA; [2001]; 1p; In English; Southwest Chapter Meeting, American College of Sports Medicine, 16-17 Nov. 2001, Salt Lake City, UT, USA

Contract(s)/Grant(s): RTOP 111-10-20; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose of this study was to investigate cardiopulmonary responses to supine cycling with concomitant +G(sub z) acceleration using the NASA/Ames Human Powered Short-Arm Centrifuge (HPC). Subjects were eight consenting males (32+/-5 yrs, 178+/-5 cm, 86.1+/- 6.2 kg). All subjects completed two maximal exercise tests on the HPC (with and without acceleration)

within a three-day period. A two tailed t-test with statistical significance set at p less than or equal to 0.05 was used to compare treatments. Peak acceleration was 3.4 ± 0.1 G(sub z), (head to foot acceleration). Peak oxygen uptake (VO_2 (sub peak) was not different between treatment groups (3.1 ± 0.1 Lmin(exp -1) vs. 3.2 ± 0.1 Lmin(exp -1) for stationary and acceleration trials, respectively). Peak HR and pulmonary minute ventilation (V (sub E(sub BTPS))) were significantly elevated (p less than or equal to 0.05) for the acceleration trial (182 ± 3 BPM (Beats per Minute); 132.0 ± 9.0 Lmin(exp -1)) when compared to the stationary trial (175 ± 3 BPM; 115.5 ± 8.5 Lmin(exp -1)). Ventilatory threshold expressed as a percent of VO_2 (sub peak) was not different for acceleration and stationary trials ($72 \pm 2\%$ vs. $68 \pm 2\%$ respectively). Results suggest that 3.4 G(sub z) acceleration does not alter VO_2 (sub peak) response to supine cycling. However, peak HR and V (sub E(sub BTPS)) response may be increased while ventilatory threshold response expressed as a function of percent VO_2 (sub peak) is relatively unaffected. Thus, traditional exercise prescription based on VO_2 response would be appropriate for this mode of exercise. Prescriptions based on HR response may require modification.

Author

Physical Exercise; Exercise Physiology; Pulmonary Circulation; Oxygen Consumption

20020069150 NASA Ames Research Center, Moffett Field, CA USA

Skeletal Adaptation to Daily Activity: A Biochemical Perspective

Whalen, Robert T., NASA Ames Research Center, USA; [2002]; 1p; In English; 8th European Symposium on Life Science Research in Space, 2-7 Jun. 2002, USA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Musculoskeletal forces generated by normal daily activity on Earth maintain the functional and structural properties of muscle and bone throughout most of one's adult life. A reduction in the level of cumulative daily loading caused by space flight, bed rest or spinal cord injury induces rapid muscle atrophy, functional changes in muscle, and bone resorption in regions subjected to the reduced loading. Bone cells in culture and bone tissue reportedly respond to a wide variety of non-mechanical and mechanical stimuli ranging, from electromagnetic fields, and hormones to small amplitude, high frequency vibrations, fluid flow, strain rate, and stress/strain magnitude. However, neither the transduction mechanism that transforms the mechanical input into a muscle or bone metabolic response nor the characteristics, of the loading history that directly or indirectly stimulates the cell is known. Identifying the factors contributing to the input stimulus will have a major impact on the design of effective countermeasures for long duration space flight. This talk will present a brief overview of current theories of bone remodeling and functional adaptation to mechanical loading. Work from our lab will be presented from the perspective of daily cumulative loading on Earth and its relationship to bone density and structure. Our objective is to use the tibia and calcaneus as model bone sites of cortical and cancellous bone adaptation, loaded daily by musculoskeletal forces in equilibrium with the ground reaction force. All materials that will be discussed are in the open scientific literature.

Author

Biochemistry; Bone Mineral Content; Musculoskeletal System; Genetics; Muscular Function

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20020068947 NASA Ames Research Center, Moffett Field, CA USA

Instructor Debrief Training in SPOT

Martin, Lynne, National Academy of Sciences - National Research Council, USA; Orasanu, Judith, NASA Ames Research Center, USA; Villeda, Eric, San Jose State Univ., USA; [2002]; 6p; In English; 10th International Symposium of Aviation Psychology, May 1999, Columbus, OH, USA

Contract(s)/Grant(s): R5085J8; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One way to enhance the effectiveness of Special Purpose Operational Training' (SPOT) debriefing sessions may be for instructors to make explicit connections between the Crew Resource Management (CRM) concepts a carrier advocates and the behaviors displayed by the crew in question. A tool listing key behaviors from the scenario was devised, accompanied by an instructors' training session in which links were made between the behaviors and the underlying CRM processes they reflect. The aim of the tool is to assist instructors to focus the debriefing on the key SPOT/ CRM issues, in this case on planning. A second tool suggested ways to facilitate the discussion. Fourteen instructors at a major U.S. carrier took part in the training session and used the toolkit in their subsequent debriefs. Pre- and post-training debriefing samples from each instructor were compared to

assess whether there were any changes in instructors' approaches to discussions in terms of the topics they covered and how they raised the points.

Author

Flight Training; Flight Crews

20020070262 Civil Aerospace Medical Inst., Oklahoma City, OK USA

A Laboratory Comparison of Clockwise and Counter-Clockwise Rapidly Rotating Shift Schedules, Part 2, Performance Final Report

Cruz, Crystal E., Civil Aerospace Medical Inst., USA; Boquet, Albert, Civil Aerospace Medical Inst., USA; Detwiler, Cristy, Civil Aerospace Medical Inst., USA; Nesthus, Thomas E., Civil Aerospace Medical Inst., USA; July 2002; 36p; In English

Contract(s)/Grant(s): FAA-AM-A-00-HRR-519

Report No.(s): DOT/FAA/AM-02/13-Pt-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many Air Traffic Control Specialists (ATCSs) work a relatively unique counter-clockwise, rapidly rotating shift schedule. Although arguments against these kinds of schedules are prevalent in the literature, few studies have examined rotating shifts such as those seen with ATCSs. The present study directly compared clockwise and counter-clockwise rapidly rotating shiftwork schedules on measures of complex task performance from the Multiple Task Performance Battery (MTPB) and vigilance from the Bakan Vigilance Task. Participants (n=28) worked day shifts for the first week of the study (0800-1600), followed by two weeks of either a clockwise (n = 14) or counter-clockwise (n = 14) shiftwork schedule. Participants completed three 1.5-hour sessions on the MTPB on each shift following the first day of training. Each session contained low, medium, and high workload periods, as well as active- and passive-task components. In addition, participants completed a .5-hour Bakan Vigilance Test at the beginning and end of each shift. There were no group differences in the overall or passive task composite scores for the MTPB. Instead, a shift by session interaction, $F(8, 19) = 5.2$, $p = .001$, indicated that performance was maintained across the afternoon shifts, was lower at the end of the early morning shifts, but fell by a much greater margin at the end of the midnight shift. Results for the active task composite scores indicated a 3-way interaction between week, shift, and rotation condition, $F(4, 23) = 4.7$, $P = .006$. This complex relationship indicated that performance was consistently higher in the counter-clockwise rotation and was less variable across shifts than in the clockwise rotation. Results of the Bakan Vigilance Task revealed a significant Rotation Condition by Shift interaction, $F(4, 23) = 6.2$, $p = .001$. While the counter-clockwise group appeared to perform consistently better than the clockwise group across all shifts, results of the simple effects analyses indicated a significant difference only on the first afternoon shift. These data do not support the hypothesis that a clockwise rotation will result in better outcomes on complex or vigilance task performance. In fact, performance in the two groups was generally equivalent, with a few exceptions in which the counter-clockwise group performed better. The empirical evidence gained from this study suggests that particular shifts, such as early morning and midnight shifts, may adversely affect sleep and performance more than the direction of shift rotation.

Author

Air Traffic Controllers (Personnel); Alertness; Workloads (Psychophysiology); Psychological Tests

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20020067744 Civil Aerospace Medical Inst., Oklahoma City, OK USA

Development of an FAA-EUROCONTROL Technique for the Analysis of Human Error in ATM Final Report

Pounds, Julia, Civil Aerospace Medical Inst., USA; Isaac, Anne, European Organization for the Safety of Air Navigation, Belgium; July 2002; 26p; In English

Contract(s)/Grant(s): FAA-HRR-518

Report No.(s): DOT/FAA/AM-02/12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Human error has been identified as a dominant risk factor in safety-oriented industries such as air traffic control (ATC). However, little is known about the factors leading to human errors in current air traffic management (ATM) systems. The first step toward prevention of human error is to develop an understanding of where it occurs in existing systems and of the system variables which contribute to its occurrence. This paper reports on the project to harmonize the Human Factors Analysis and Classification System (HFACS) and the Human Error Reduction in ATM (HERA) technique. Two groups of air traffic control subject-matter experts (SMEs) participated. The first group analyzed incident cases using each technique and identified the useful concepts from each technique for these cases. The second group evaluated the concepts identified by the first group. Based on

these activities, the techniques were deemed to be compatible and harmonization proceeded. Elements from both techniques were retained and many were elaborated based on the SMEs feedback. The integrated approach, called JANUS, is currently undergoing beta testing by seven European nations and the US Federal Aviation Administration.

Author

Error Analysis; Air Traffic Control; Safety; Management Systems; Human Performance

20020067801 Institute for Human Factors TNO, Soesterberg, Netherlands

The Design and Fit Evaluation of a Biological Facelet Final Report Ontwerp en Pasvorm Van Een Halfgelaatsmasker Tegen Biologische Agentia

Cable, D. R. M., Institute for Human Factors TNO, Netherlands; Daanen, H. A. M., Institute for Human Factors TNO, Netherlands; Feb. 27, 2002; 38p; In English; Original contains color illustrations

Contract(s)/Grant(s): 013.10377; TNO Proj. 789.2

Report No.(s): TD-2001-0369; TM-02-A012; Copyright; Avail: Issuing Activity

With the increase of international commerce, international companies may find themselves providing equipment to many different countries. This leads to situations where protective equipment designs are not adequate to accommodate the diversity of users and their anthropometric details. The European Standard (EN136) provides four facial dimensions to describe subjects when conducting tests for respiratory protective equipment. These are: Face length, Face width, Face depth, and Mouth width, all measured in millimeters. It is hard to identify facial dimensions that can be reliable indicators of fit. It cannot be expected that by using only the four dimensions stated above, that designs will be provided that produce high protection levels and good facial fit for a multitude of users from different countries. The aim of this project was to provide a new design for a biological facelet for the Netherlands Army. This new design would be achieved by the use of a new method of applying and analyzing facial anthropometrics. In this report, the new process of designing a biological facelet and the final concept are presented as well as the conclusions and benefits of this project. The main source of data for the project was the NedScan database.

Author

Anthropometry; Masks; Human Factors Engineering; Three Dimensional Models; Face (Anatomy); Design Analysis

20020068805 Tennessee Univ., Coll. of Engineering and Computer Science, Chattanooga, TN USA

Human Motion Tracking and Glove-Based User Interfaces for Virtual Environments in ANVIL

Dumas, Joseph D., II, Tennessee Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XIII-1 - XIII-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Army/NASA Virtual Innovations Laboratory (ANVIL) at Marshall Space Flight Center (MSFC) provides an environment where engineers and other personnel can investigate novel applications of computer simulation and Virtual Reality (VR) technologies. Among the many hardware and software resources in ANVIL are several high-performance Silicon Graphics computer systems and a number of commercial software packages, such as Division MockUp by Parametric Technology Corporation (PTC) and Jack by Unigraphics Solutions, Inc. These hardware and software platforms are used in conjunction with various VR peripheral I/O (input / output) devices, CAD (computer aided design) models, etc. to support the objectives of the MSFC Engineering Systems Department/Systems Engineering Support Group (ED42) by studying engineering designs, chiefly from the standpoint of human factors and ergonomics. One of the more time-consuming tasks facing ANVIL personnel involves the testing and evaluation of peripheral I/O devices and the integration of new devices with existing hardware and software platforms. Another important challenge is the development of innovative user interfaces to allow efficient, intuitive interaction between simulation users and the virtual environments they are investigating. As part of his Summer Faculty Fellowship, the author was tasked with verifying the operation of some recently acquired peripheral interface devices and developing new, easy-to-use interfaces that could be used with existing VR hardware and software to better support ANVIL projects.

Derived from text

Computerized Simulation; Human Factors Engineering; Virtual Reality; Human-Computer Interface; Computer Components

20020068997 NASA Ames Research Center, Moffett Field, CA USA

Computational Model of Human and System Dynamics in Free Flight: Studies in Distributed Control Technologies

Corker, Kevin M., NASA Ames Research Center, USA; Pisanich, Gregory, Raytheon Systems Co., USA; [1998]; 6p; In English; Human Factors and Ergonomics Conference, 6-9 Oct. 1998, Chicago, IL, USA

Contract(s)/Grant(s): RTOP 538-04-21; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a set of studies in full mission simulation and the development of a predictive computational model of human performance in control of complex airspace operations. NASA and the FAA have initiated programs of research and

development to provide flight crew, airline operations and air traffic managers with automation aids to increase capacity in en route and terminal area to support the goals of safe, flexible, predictable and efficient operations. In support of these developments, we present a computational model to aid design that includes representation of multiple cognitive agents (both human operators and intelligent aiding systems). The demands of air traffic management require representation of many intelligent agents sharing world-models, coordinating action/intention, and scheduling goals and actions in a potentially unpredictable world of operations. The operator-model structure includes attention functions, action priority, and situation assessment. The cognitive model has been expanded to include working memory operations including retrieval from long-term store, and interference. The operator's activity structures have been developed to provide for anticipation (knowledge of the intention and action of remote operators), and to respond to failures of the system and other operators in the system in situation-specific paradigms. System stability and operator actions can be predicted by using the model. The model's predictive accuracy was verified using the full-mission simulation data of commercial flight deck operations with advanced air traffic management techniques.

Author

Human Performance; Air Traffic Control; Airline Operations; Control Simulation; Computerized Simulation; Performance Prediction; Systems Analysis; Mathematical Models

20020069124 NASA Ames Research Center, Moffett Field, CA USA

Status of Regenerative Life Support Research and Technology Program at NASA Ames Research Center

Kliss, Mark, NASA Ames Research Center, USA; [1998]; 17p; In English; IES-CELSS International Conference on Closed Ecological Systems for Terrestrial and Space Applications, 21-23 Jul. 1998, Obuchi, Japan; Sponsored by Institute of Ecosystem Studies, USA

Contract(s)/Grant(s): RTOP 199-61-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

1. Provide Advanced Life Support technologies that significantly reduce life cycle costs, improve operational performance, promote self-sufficiency, and minimize expenditure of resources for missions of long duration. 2. Develop and apply methods of systems analysis and engineering to guide investments in technology, resolve and integrate competing needs, and guide evolution of advanced life support systems. 3. Resolve issues of hypogravity performance through space flight research and evaluation. 4. Ensure timely transfer of new life support technologies to missions. 5. Transfer technologies to private sectors for national benefit.

Derived from text

Life Support Systems; Systems Analysis; Research and Development; Microgravity

20020070277 Colorado Univ., BioServe Space Technologies, Boulder, CO USA

The Utilization of a Space Flight Plant Growth Chamber in the Cultivation of Salad Crop Species: A Prelude to a Salad Machine

Heyenga, A. G., Colorado Univ., USA; Hoehn, A., Colorado Univ., USA; Stodieck, L. S., Colorado Univ., USA; Kliss, M., NASA Ames Research Center, USA; [1998]; 1p; In English; International Conference for Life Support Science, January 1999, Houston, TX, USA

Contract(s)/Grant(s): NCC2-5258; No Copyright; Avail: Issuing Activity; Abstract Only

The application of bioregenerative life support systems provides an attractive approach to minimize resupply requirement and ultimate self-sufficiency on long duration manned missions in space. The on-board cultivation of salad-type vegetables for crew consumption has been proposed as a first step approach towards reducing a total reliance on the resupply of food. The recent advances in the development of space flight plant growth facilities such as the Plant Generic Bioprocessing Apparatus (PGBA) have established a firm technical basis upon which the implementation of a 'salad machine' concept may be achieved. A presentation on ground based studies will be made evaluating (a) the operational performance of the PGBA facility in a crop production mode and (b) the qualitative and quantitative value of salad plant material produced within the chamber.

Author

Crop Growth; Farm Crops; Vegetables; Food Production (In Space); Manned Space Flight

20020070282 NASA Ames Research Center, Moffett Field, CA USA

BIO-Plex Information System Concept

Jones, Harry, NASA Ames Research Center, USA; Boulanger, Richard, Sverdrup Technology, Inc., USA; [1999]; 1p; In English; International Conference for Life Support Science, Jan. 1999, Houston, TX, USA

Contract(s)/Grant(s): RTOP 199-61-01; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes a suggested design for an integrated information system for the proposed BIO-Plex (Bioregenerative Planetary Life Support Systems Test Complex) at Johnson Space Center (JSC), including distributed control systems, central

control, networks, database servers, personal computers and workstations, applications software, and external communications. The system will have an open commercial computing and networking architecture. The network will provide automatic real-time transfer of information to database server computers which perform data collection and validation. This information system will support integrated, data sharing applications for everything, from system alarms to management summaries. Most existing complex process control systems have information gaps between the different real time subsystems, between these subsystems and central controller, between the central controller and system level planning and analysis application software, and between the system level applications and management overview reporting. An integrated information system is vitally necessary as the basis for the integration of planning, scheduling, modeling, monitoring, and control, which will allow improved monitoring and control based on timely, accurate and complete data. Data describing the system configuration and the real time processes can be collected, checked and reconciled, analyzed and stored in database servers that can be accessed by all applications. The required technology is available. The only opportunity to design a distributed, nonredundant, integrated system is before it is built. Retrofit is extremely difficult and costly.

Author

Information Systems; Integrated Circuits; Active Control; Applications Programs (Computers); Data Acquisition

20020070283 NASA Ames Research Center, Moffett Field, CA USA

Advanced Life Support System Value Metric

Jones, Harry W., NASA Ames Research Center, USA; [1999]; 1p; In English; International Conference for Life Support Science, Jan. 1999, Houston, TX, USA

Contract(s)/Grant(s): RTOP 199-61-01; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA Advanced Life Support (ALS) Program is required to provide a performance metric to measure its progress in system development. Extensive discussions within the ALS program have reached a consensus. The Equivalent System Mass (ESM) metric has been traditionally used and provides a good summary of the weight, size, and power cost factors of space life support equipment. But ESM assumes that all the systems being traded off exactly meet a fixed performance requirement, so that the value and benefit (readiness, performance, safety, etc.) of all the different systems designs are exactly equal. This is too simplistic. Actual system design concepts are selected using many cost and benefit factors and the system specification is then set accordingly. The ALS program needs a multi-parameter metric including both the ESM and a System Value Metric (SVM). The SVM would include safety, maintainability, reliability, performance, use of cross cutting technology, and commercialization potential. Another major factor in system selection is technology readiness level (TRL), a familiar metric in ALS. The overall ALS system metric that is suggested is a benefit/cost ratio, $[SVM + TRL]/ESM$, with appropriate weighting and scaling. The total value is the sum of SVM and TRL. Cost is represented by ESM. The paper provides a detailed description and example application of the suggested System Value Metric.

Author

Life Support Systems; Maintainability; Safety; Specifications; Technology Assessment

55

EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

20020070289 NASA Ames Research Center, Moffett Field, CA USA

Identification of Extraterrestrial Microbiology

Flynn, Michael, NASA Ames Research Center, USA; [1998]; 1p; In English; International Conference on Environmental Systems, 12-15 Jul. 1999, Denver, CO, USA

Contract(s)/Grant(s): RTOP 839-88-20; No Copyright; Avail: Issuing Activity; Abstract Only

Many of the key questions addressed in the field of Astrobiology are based upon the assumption that life exists, or at one time existed, in locations throughout the universe. However, this assumption is just that, an assumption. No definitive proof exists. On Earth, life has been found to exist in many diverse environment. We believe that this tendency towards diversity supports the assumption that life could exists throughout the universe. This paper provides a summary of several innovative techniques for

the detection of extraterrestrial life forms. The primary questions addressed are does life currently exist beyond Earth and if it does, is that life evolutionary related to life on Earth?

Author

Extraterrestrial Life; Microbiology; Life Sciences; Exobiology

59

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.

20020069077 Technische Univ., Faculty of Mathematical Sciences, Twente, Netherlands

Norm of an Averaging Operator

Martini, R.; Post, G. F.; Apr. 2001; 12p; In English

Report No.(s): PB2002-106054; MEMO-1578; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

No abstract available.

NTIS

Operators (Mathematics); Norms

20020069078 Rutherford Appleton Lab., Computational Science and Engineering Dept., Oxford, UK

Implementing Hager's Exchange Methods for Matrix Profile Reduction

Reid, J. K.; Scott, J. A.; Nov. 01, 2001; 26p; In English

Report No.(s): PB2002-106053; RAL-TR-2001-039; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Hager recently introduced down and up exchange methods for reducing the profile of a sparse matrix with a symmetric scarcity pattern. The methods are particularly useful for refining orderings that have been obtained using a standard profile reduction algorithm, such as the Sloan method. The running times for the exchange algorithms reported by Hager suggested their cost could be prohibitive for practical applications. We examine how to implement the exchange algorithms efficiently. For a range real test problems, it is shown that the cost of running our new implementation does not add a prohibitive overhead to the cost of the original reordering.

NTIS

Matrix Methods; Matrices (Mathematics); Refining

20020070680 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Geometric Simple Connectivity in Four- Dimensional Differential Topology. Part A

Poenaru, V.; Oct. 2001; 328p; In English

Report No.(s): PB2002-105020; IHES/M/01/45; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

Let Δ^4 be a smooth compact 4-manifold the boundary of which is a homology sphere Δ^4 and which is geometrically simply-connected at long distance. Then the open manifold $(1,4)$ (where the infinite connected sum is taken along the boundaries) admits a smooth PROPER handlebody decomposition without handles of index $\Lambda=1$, i.e. Y^4 is geometrically simply-connected.

NTIS

Topology; Manifolds (Mathematics); Decomposition

60

COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

20020068007 Computer Sciences Corp., USA

OpenMP Experiences and Comparisons

Nelson, Terry, Computer Sciences Corp., USA; Apr. 25, 2002; 6p; In English; Cray User Group, 20-24 May 2002, Manchester, UK; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The document discusses message passage interfaces (MPI), open message passage issues and parallelization. A comparison of the two vector platforms, C90 and SVlex is presented. Sections of the document are written in computer code.

CASI

Data Transmission; Supercomputers; Interprocessor Communication

20020068956 NASA Goddard Space Flight Center, Greenbelt, MD USA

Description of Data Archiving Associated With the NASA Goddard Grant NAGS-9590 Final Report

Simmons, K. E., NASA Goddard Space Flight Center, USA; Aug. 01, 2002; 1p; In English

Contract(s)/Grant(s): NAGS-0590; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Data restoration and archiving activities for this project have resulted in the restoration of 100% of the original Mariner 9 raw data set as well as many of the secondary analysis data sets. These data sets have been submitted to the Planetary Data System (PDS) Atmospheric Node, along with their PDS labels and descriptive metadata. In addition, a useful visualization and analysis tool has also been developed which allows the user to compare these Mariner 1971 Ultraviolet spectral data with several choices of related data sets: Mariner 9 images, USGS geologic data, MGS MOLA topography, Viking images (Viking MDIM) and thermal inertia data (MGS TES).

Author

Mariner 9 Space Probe; Data Retrieval

20020069121 MRJ Technology Solutions, Inc., Moffett Field, CA USA

On the Efficacy of Source Code Optimizations for Cache-Based Systems

VanderWijngaart, Rob F., MRJ Technology Solutions, Inc., USA; Saphir, William C., California Univ., Lawrence Berkeley National Lab., USA; [1998]; 24p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Obtaining high performance without machine-specific tuning is an important goal of scientific application programmers. Since most scientific processing is done on commodity microprocessors with hierarchical memory systems, this goal of "portable performance" can be achieved if a common set of optimization principles is effective for all such systems. It is widely believed, or at least hoped, that portable performance can be realized. The rule of thumb for optimization on hierarchical memory systems is to maximize temporal and spatial locality of memory references by reusing data and minimizing memory access stride. We investigate the effects of a number of optimizations on the performance of three related kernels taken from a computational fluid dynamics application. Timing the kernels on a range of processors, we observe an inconsistent and often counterintuitive impact of the optimizations on performance. In particular, code variations that have a positive impact on one architecture can have a negative impact on another, and variations expected to be unimportant can produce large effects. Moreover, we find that cache miss rates - as reported by a cache simulation tool, and confirmed by hardware counters - only partially explain the results. By contrast, the compiler-generated assembly code provides more insight by revealing the importance of processor-specific instructions and of compiler maturity, both of which strongly, and sometimes unexpectedly, influence performance. We conclude that it is difficult to obtain performance portability on modern cache-based computers, and comment on the implications of this result.

Author

Microprocessors; Memory (Computers); Architecture (Computers); Computer Programming; Optimization

20020069146 NASA Ames Research Center, Moffett Field, CA USA

Development and Applications of a Modular Parallel Process for Large Scale Fluid/Structures Problems

Guruswamy, Guru P., NASA Ames Research Center, USA; [2002]; 16p; In English; 6th International Conference on High Performance Computing, 16-19 Dec. 2002, Bangalore, India; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A modular process that can efficiently solve large scale multidisciplinary problems using massively parallel supercomputers is presented. The process integrates disciplines with diverse physical characteristics by retaining the efficiency of individual disciplines. Computational domain independence of individual disciplines is maintained using a meta programming approach. The process integrates disciplines without affecting the combined performance. Results are demonstrated for large scale aerospace problems on several supercomputers. The super scalability and portability of the approach is demonstrated on several parallel computers.

Author

Massively Parallel Processors; Parallel Processing (Computers); Systems Analysis; Multidisciplinary Design Optimization

20020070278 NASA Ames Research Center, Moffett Field, CA USA

Graphics Flip Cube for Supercomputing 1998

Gong, Chris, NASA Ames Research Center, USA; [1998]; 1p; In English; Supercomputing 1998 Conference, 7-13 Nov. 1998, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 519-40-22; No Copyright; Avail: Issuing Activity; Abstract Only

Flip cube (constructed of heavy plastic) displays 11 graphics representing current projects or demos from 5 NASA centers participating in Supercomputing '98 (SC98). Included with the images are the URLs and names of the NASA centers.

Author

Display Devices; Plastics; Cubes (Mathematics); Blocks

20020070375 NASA Ames Research Center, Moffett Field, CA USA

Systems Issues Pertaining to Holographic Optical Data Storage in Thick Bacteriorhodopsin Films

Downie, John D., NASA Ames Research Center, USA; Timucin, Dogan A., Caelum Research Corp., USA; Gary, Charles K., RECOM Software, Inc., USA; Oezcan, Meric, RECOM Software, Inc., USA; Smithey, Daniel T., Bend Research, Inc., USA; Crew, Marshall, Bend Research, Inc., USA; [1998]; 1p; In English; Optical Society of America Annual Meeting, 4-9 Oct. 1998, Baltimore, MD, USA; Sponsored by Optical Society of America, USA

Contract(s)/Grant(s): RTOP 632-10-00; No Copyright; Avail: Issuing Activity; Abstract Only

The optical data storage capacity and raw bit-error-rate achievable with thick photochromic bacteriorhodopsin (BR) films are investigated for sequential recording and read-out of angularly- and shift-multiplexed digital holograms inside a thick blue-membrane D85N BR film. We address the determination of an exposure schedule that produces equal diffraction efficiencies among each of the multiplexed holograms. This exposure schedule is determined by numerical simulations of the holographic recording process within the BR material, and maximizes the total grating strength. We also experimentally measure the shift selectivity and compare the results to theoretical predictions. Finally, we evaluate the bit-error-rate of a single hologram, and of multiple holograms stored within the film.

Author

Optical Memory (Data Storage); Bacteria; Thick Films; Photochromism; Holography

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20020067716 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Using EVMS with COTS-Based Systems Final Report

Staley, Mary Jo; Oberndorf, Patricia; Sledge, Carol A.; Jun. 2002; 62p; In English

Contract(s)/Grant(s): F19828-00-C-0003

Report No.(s): AD-A403815; CMU/SEI-2002-TR-022; ESC-TR-2002-022; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

With the increased use of commercial off-the-shelf (COTS) software products, managers of software development projects must deal with planning and tracking performance of projects that have new challenges and risks. A system developer may be required to integrate multiple COTS products with newly developed custom components and legacy system components. How are these new activities and tasks planned and monitored? Can traditional management methods be used? Earned Value is a project management tool used extensively to plan and monitor performance against the plan. This paper's focus is on the use of Earned Value in the context of a COTS- Based System (CBS). It's written for an audience already familiar with Earned Value Project Management; only the basic definitions are discussed here with the associated terminology. A bibliography is included, offering good sources for obtaining more in-depth information on Earned Value history and methodology.

DTIC

Systems Management; Project Management; Management Methods; Terminology

20020067725 Computer Sciences Corp., Moffett Field, CA USA

Computational Nanotechnology Molecular Electronics, Materials and Machines

Srivastava, Deepak, Computer Sciences Corp., USA; [2002]; 7p; In English; Nanobusiness Alliance Panel, 20-21 May 2002, New York, NY, San Jose, CA, USA, USA

Contract(s)/Grant(s): RTOP 704-40-32; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This presentation covers research being performed on computational nanotechnology, carbon nanotubes and fullerenes at the NASA Ames Research Center. Topics cover include: nanomechanics of nanomaterials, nanotubes and composite materials, molecular electronics with nanotube junctions, kinky chemistry, and nanotechnology for solid-state quantum computers using fullerenes.

CASI

Nanotechnology; Carbon Nanotubes; Nanostructure (Characteristics)

20020067726 NASA Ames Research Center, Moffett Field, CA USA

Enabling Computational Nanotechnology through JavaGenes in a Cycle Scavenging Environment

Globus, Al, NASA Ames Research Center, USA; Menon, Madhu, Kentucky Univ., USA; Srivastava, Deepak, NASA Ames Research Center, USA; [2002]; 10p; In English; Supercomputing 2002, Unknown

Contract(s)/Grant(s): DTT59-99-D-00437; NASA Order A-61812-D; RTOP 704-40-32; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A genetic algorithm procedure is developed and implemented for fitting parameters for many-body inter-atomic force field functions for simulating nanotechnology atomistic applications using portable Java on cycle-scavenged heterogeneous workstations. Given a physics based analytic functional form for the force field, correlated parameters in a multi-dimensional environment are typically chosen to fit properties given either by experiments and/or by higher accuracy quantum mechanical simulations. The implementation automates this tedious procedure using an evolutionary computing algorithm operating on hundreds of cycle-scavenged computers. As a proof of concept, we demonstrate the procedure for evaluating the Stillinger-Weber (S-W) potential by (a) reproducing the published parameters for Si using S-W energies in the fitness function, and (b) evolving a "new" set of parameters using semi-empirical tightbinding energies in the fitness function. The "new" parameters are significantly better suited for Si cluster energies and forces as compared to even the published S-W potential.

Author

Nanotechnology; Genetic Algorithms; Molecular Dynamics; Computerized Simulation; Field Theory (Physics); Parameter Identification

20020067745 NASA Ames Research Center, Moffett Field, CA USA

Tera Scale Systems and Applications

Niggley, Chuck, NASA Ames Research Center, USA; Ciotti, Bob, NASA Ames Research Center, USA; [2002]; 25p; In English; Cray Users Group Summit 2002, 20-24 May 2002, Manchester, UK; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation discusses NASA's efforts to develop tera scale systems designed to push the envelope of supercomputing research. Topics cover include: NASA's existing supercomputing facilities and capabilities, NASA's computational challenges in developing these systems, development of production supercomputer, and potential research projects which could benefit from these types of systems.

CASI

Supercomputers; Parallel Processing (Computers); Computer Systems Design; Parallel Computers

20020067771 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Use of the Architecture Tradeoff Analysis MethodSM (ATAMSM) in Source Selection of Software-Intensive Systems Final Report

Bergey, John K.; Fisher, Matthew J.; Jones, Lawrence G.; Jun. 2002; 47p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A403813; CMU/SEI-2002-TN-010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Software architecture is critical to the quality of a software-intensive system. For an acquisition organization, such as the Department of Defense (DoD), the ability to evaluate software architectures as early as possible in an acquisition can have a favorable impact on the delivered system. This technical note explains the role of software architecture evaluation in a source selection and describes the contractual elements that are needed to support its use. The note then briefly describes the Architecture

Tradeoff Analysis MethodsM (ATAMsM) and provides an example that shows how to apply this method in a source selection. The example includes sample contractual language that an acquirer can adapt to meet specific acquisition needs.

DTIC

Tradeoffs; Software Engineering; Computer Systems Programs; Architecture (Computers)

20020067772 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

A Software Product Line Vision for Defense Acquisition *Final Report*

Campbell, Grady H., Jr.; Jun. 2002; 51p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A403810; CMU/SEI-2002-TN-002; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Experience in industry and government over the last 10 years has shown that a software product line approach can significantly improve productivity and product quality, facilitate change, and reduce life-cycle costs. Defense acquisition policy calls for such improvements related to software but makes no explicit mention of a product line approach as an option. Although policy gives program managers sufficient flexibility to adopt a product line approach, there is little awareness of this possibility and considerable uncertainty concerning when and how to do it. This note presents a vision for software product lines as an acquisition focus and suggests extensions to current Department of Defense policy and practices to increase the awareness of and receptivity to product line acquisition as a viable alternative.

DTIC

Software Engineering; Production Engineering; Productivity; Defense Industry

20020067774 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

MAP and OAR Methods: Techniques for Developing Core Assets for Software Product Lines from Existing Assets *Final Report*

O'Brien, Liam; Smith, Dennis; Apr. 2002; 35p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A403805; CMU/SEI-2002-TN-007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While it is commonly recognized that legacy assets are, in most cases, an important contributor to the core assets for software product lines, systematic methods for making decisions on when to incorporate legacy assets (versus building new assets) have not been available. Two methods developed by the Software Engineering Institute fill this gap: the Mining Architectures for Product Lines (MAP) method and the Options Analysis for Reengineering (OAR) method. Both of these methods, which are described in this report, support different aspects of the Product Parts Pattern, which is applied to develop the core assets for a product line. The MAP method provides a suitability analysis of existing systems' software architectures as candidates for a product line architecture. After an architecture has been developed or chosen, the OAR method provides a disciplined approach for making decisions on rehabilitating legacy assets that may be incorporated into the product line asset base.

DTIC

Software Engineering; Computer Systems Programs; Computer Programming; Mining

20020068010 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia

A Bayesian Track-before-Detect Algorithm for IR Point Target Detection

Warren, Robert C.; Feb. 2002; 31p; In English

Report No.(s): AD-A404151; DSTO-TR-1281; DODA-AR-012-164; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An algorithm has been developed for the detection of point targets in uncluttered background based on a Bayesian track before detect method. The algorithm has an application in the detection of sea skimming antiship missiles at maximum range, when the missile appears over the horizon. Because of the long range, angular motion of the target will be insignificant, and target motion cannot be used to aid detection. The effect of filtering with a number of spatial filters on detection efficiency is assessed. The algorithm was tested on an infrared image sequence of an aircraft approaching the sensor at low level over water with a diffuse cloud background, and it was found to perform significantly better than simple detection by threshold exceedance. The algorithm is intended for application on a massively parallel processor where each pixel is assigned to a processing element, and each pixel is considered to be an individual sensor.

DTIC

Algorithms; Infrared Detectors; Bayes Theorem; Target Recognition

20020068076 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Software Process Improvement and Product Line Practice: CMMI and the Framework for Software Product Line Practice Final Report

Jones, Lawrence G.; Soule, Albert L.; Jul. 2002; 37p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A403868; CMU/SEI-2002-TN-012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many organizations report dramatic benefits from the adoption of software product line practice. Organizations that have established software engineering process discipline are better poised to succeed with product lines. While we acknowledge that there are different paths to successful process discipline, in this technical note, we concentrate on approaches based on the Capability Maturity Model Integration (CMMI) models. We describe practices that are most crucial to product line success. While some of these relate directly to the CMMI models process areas, others are uniquely important to product lines. In this technical note, we first present fundamental concepts of software product lines. We then describe important product line practices as they have been documented in A Framework for Software Product Line Practice (framework). We next present an overview of the CMMI models, followed by a description of the general relationships between the framework and CMMI models. We amplify this comparison with a detailed example showing the relationship between configuration management practices in CMMI and in the framework. We conclude by describing the ways in which organizations can build upon their process improvement efforts to achieve success with product lines and realize additional benefits through the use of both technologies.

DTIC

Software Engineering; Production Engineering

20020068709 Computer Science Corp., Moffett Field, CA USA

NASA Advanced Supercomputing (NAS) User Services Group

Pandori, John, Computer Science Corp., USA; Hamilton, Chris, Computer Science Corp., USA; Niggley, C. E., Computer Science Corp., USA; Apr. 24, 2002; 28p; In English; CUG Summit 2002, 20-24 May 2002, Manchester, England, UK; Sponsored by Cray User Group, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides an overview of NAS (NASA Advanced Supercomputing), its goals, and its mainframe computer assets. Also covered are its functions, including systems monitoring and technical support.

CASI

Supercomputers; Research Facilities

20020068833 Christian Brothers Univ., Mechanical Engineering Dept., Memphis, TN USA

Comparisons of Kinematics and Dynamics Simulation Software Tools

Shiue, Yeu-Sheng Paul, Christian Brothers Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLVII-1 - XLVII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Kinematic and dynamic analyses for moving bodies are essential to system engineers and designers in the process of design and validations. 3D visualization and motion simulation plus finite element analysis (FEA) give engineers a better way to present ideas and results. Marshall Space Flight Center (MSFC) system engineering researchers are currently using IGRIP from DELMIA Inc. as a kinematic simulation tool for discrete bodies motion simulations. Although IGRIP is an excellent tool for kinematic simulation with some dynamic analysis capabilities in robotic control, explorations of other alternatives with more powerful dynamic analysis and FEA capabilities are necessary. Kinematics analysis will only examine the displacement, velocity, and acceleration of the mechanism without considering effects from masses of components. With dynamic analysis and FEA, effects such as the forces or torques at the joint due to mass and inertia of components can be identified. With keen market competition, ALGOR Mechanical Event Simulation (MES), MSC visualNastran 4D, Unigraphics Motion+, and Pro/MECHANICA were chosen for explorations. In this study, comparisons between software tools were presented in terms of following categories: graphical user interface (GUI), import capability, tutorial availability, ease of use, kinematic simulation capability, dynamic simulation capability, FEA capability, graphical output, technical support, and cost. Propulsion Test Article (PTA) with Fastrac engine model exported from IGRIP and an office chair mechanism were used as examples for simulations.

Author

Motion Simulation; Kinematics; Finite Element Method; Applications Programs (Computers); Computerized Simulation

20020068943 NASA Goddard Space Flight Center, Greenbelt, MD USA

Software Engineering Support of the Third Round of Scientific Grand Challenge Investigations: An Earth Modeling System Software Framework Strawman Design that Integrates Cactus and UCLA/UCB Distributed Data Broker *Final Report*

Talbot, Bryan, Analytic Sciences Corp., USA; Zhou, Shu-Jia, Analytic Sciences Corp., USA; Higgins, Glenn, Analytic Sciences Corp., USA; June 2002; 68p; In English

Report No.(s): NASA/TM-2001-209993; Rept-2001-03967-0; NAS 1.15:209993; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

One of the most significant challenges in large-scale climate modeling, as well as in high-performance computing in other scientific fields, is that of effectively integrating many software models from multiple contributors. A software framework facilitates the integration task, both in the development and runtime stages of the simulation. Effective software frameworks reduce the programming burden for the investigators, freeing them to focus more on the science and less on the parallel communication implementation, while maintaining high performance across numerous supercomputer and workstation architectures. This document proposes a strawman framework design for the climate community based on the integration of Cactus, from the relativistic physics community, and UCLA/UCB Distributed Data Broker (DDB) from the climate community. This design is the result of an extensive survey of climate models and frameworks in the climate community as well as frameworks from many other scientific communities. The design addresses fundamental development and runtime needs using Cactus, a framework with interfaces for FORTRAN and C-based languages, and high-performance model communication needs using DDB. This document also specifically explores object-oriented design issues in the context of climate modeling as well as climate modeling issues in terms of object-oriented design.

Author

Software Engineering; Climate Models; Distributed Processing; Computerized Simulation; Architecture (Computers); Data Integration; Mathematical Models

20020068955 National Inst. of Standards and Technology, Gaithersburg, MD USA

Understanding Part Fabrication Errors in Closed-Loop Machining Systems

Bandy, H. T.; Welsch, L. A.; Jun. 2002; 44p; In English

Report No.(s): PB2002-106710; NISTIR-6876; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper clarifies the relationships between different types of part errors involved in error compensation for closed-loop machining. Measurement error (i.e., inaccuracies due to operator performance, or to the geometry, action, response, or repeatability of measurement instrumentation, etc.) are not within the scope of the discussion, with the exception of machine tool geometric errors. The paper uses diagrams, equations, software engineering modeling techniques, and exposition to describe the relationships between the different types of part errors. One benefit is to enhance the understanding of part error data to facilitate the development of error compensation algorithms and related software. Another benefit is to provide a way to organize the representation of error and error compensation data for closed-loop machining systems. The paper addresses a scenario with a closed-loop machining system that includes a machine tool, nominal part design and inspection data, a geometric-thermal (GT) model of the machine tool, process-intermittent error compensation capability with an on-machine dimensional inspection probe, a coordinate measuring machine (CMM), and other features.

NTIS

Computer Aided Manufacturing; Errors; Machining; Computer Programming; Data Systems

20020068958 NASA Ames Research Center, Moffett Field, CA USA

Rebound: A Framework for Automated Component Adaptation

Penix, John, NASA Ames Research Center, USA; [1998]; 8p; In English; Workshop on Software Reuse, March 1999, Austin, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The REBOUND adaptation framework organizes a collection of adaptation tactics in a way that they can be selected based on the components available for adaptation. Adaptation tactics are specified formally in terms of the relationship between the component to be adapted and the resulting adapted component. The tactic specifications are used as matching conditions for specification-based component retrieval, creating a 'retrieval for adaptation' scenario. The results of specification matching are used to guide component adaptation. Several examples illustrate how the framework guides component and tactic selection and how basic tactics are composed to form more powerful tactics.

Author

Software Reuse; Computer Programming; Architecture (Computers)

20020068984 NASA Ames Research Center, Moffett Field, CA USA

Code Optimization and Parallelization on the Origins: Looking from Users' Perspective

Chang, Yan-Tyng Sherry, NASA Ames Research Center, USA; Apr. 25, 2002; 12p; In English; Cray User Group Meeting, 20-24 May 2002, Manchester, UK

Contract(s)/Grant(s): ARC320.000.2; ARC330.000.2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Parallel machines are becoming the main compute engines for high performance computing. Despite their increasing popularity, it is still a challenge for most users to learn the basic techniques to optimize/parallelize their codes on such platforms. In this paper, we present some experiences on learning these techniques for the Origin systems at the NASA Advanced Supercomputing Division. Emphasis of this paper will be on a few essential issues (with examples) that general users should master when they work with the Origins as well as other parallel systems.

Author

Supercomputers; Parallel Computers; Education

20020068988 Argonne National Lab., IL USA

Need for Multiple Approaches in Collaborative Software Development

LePoire, D. J.; 2002; 14p; In English

Report No.(s): DE2002-42168; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The need to share software and reintegrate it into new applications presents a difficult but important challenge. Component-based development as an approach to this problem is receiving much attention in professional journals and academic curricula. However, there are many other approaches to collaborative software development that might be more appropriate. This paper reviews a few of these approaches and discusses criteria for the conditions and contexts in which these alternative approaches might be more appropriate. This paper complements the discussion of context-based development team organizations and processes. Examples from a small development team that interacts with a larger professional community are analyzed.

NTIS

Software Engineering; Computer Programming; Computer Programs

20020069000 MRJ Technology Solutions, Inc., USA

exVis and Wind Tunnel Experiment Data

Uelton, Samuel P., MRJ Technology Solutions, Inc., USA; Jul. 01, 1998; 8p; In English

Contract(s)/Grant(s): RTOP 519-40-72; RTOP 519-10-62; Copyright; Avail: Issuing Activity

exVis is the product of a collaboration between visualization specialists and aer scientists at NASA Ames investigating how information technology can be applied to improve the aeronautical design process. exVis is a useful software tool for interactive visualization of wind tunnel experiment data, but the development of exVis was also used to support other goals, including building trust and confidence in a new collaboration and exposing requirements for an infrastructure of reusable software libraries appropriate for rapid prototyping of visualization tools, and testing of visualization research ideas. The breadth of applicability of exVis arose as a design goal in response to a rapidly increasing list of data acquisition technologies being tested in laboratories and wind tunnels. This feature is demonstrated via several examples. The system design and the collaborative development process are described elsewhere in detail.

Author

Wind Tunnel Tests; Flow Visualization; Aeronautical Engineering; Aerodynamics; Aircraft Design; Applications Programs (Computers)

20020069014 NASA Goddard Space Flight Center, Greenbelt, MD USA

Software Engineering Support of the Third Round of Scientific Grand Challenge Investigations: Earth System Modeling Software Framework Survey

Talbot, Bryan, Analytic Sciences Corp., USA; Zhou, Shu-Jia, Analytic Sciences Corp., USA; Higgins, Glenn, Analytic Sciences Corp., USA; May 2002; 86p; In English

Report No.(s): NASA/TM-2001-209992; Rept-2001-03976-0; NAS 1.15:209992; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

One of the most significant challenges in large-scale climate modeling, as well as in high-performance computing in other scientific fields, is that of effectively integrating many software models from multiple contributors. A software framework facilitates the integration task, both in the development and runtime stages of the simulation. Effective software frameworks reduce the programming burden for the investigators, freeing them to focus more on the science and less on the parallel communication implementation, while maintaining high performance across numerous supercomputer and workstation

architectures. This document surveys numerous software frameworks for potential use in Earth science modeling. Several frameworks are evaluated in depth, including Parallel Object-Oriented Methods and Applications (POOMA), Cactus (from the relativistic physics community), Overture, Goddard Earth Modeling System (GEMS), the National Center for Atmospheric Research Flux Coupler, and UCLA/UCB Distributed Data Broker (DDB). Frameworks evaluated in less detail include ROOT, Parallel Application Workspace (PAWS), and Advanced Large-Scale Integrated Computational Environment (ALICE). A host of other frameworks and related tools are referenced in this context. The frameworks are evaluated individually and also compared with each other.

Author

Earth Sciences; Software Engineering; Computerized Simulation; Atmospheric Models; Computer Programming

20020069072 Rutherford Appleton Lab., Computational Science and Engineering Dept., Oxford, UK

Preprocessing for Quadratic Programming

Gould, N. I. M.; Toint, P. L.; Jan. 2002; 44p; In English

Report No.(s): PB2002-106050; RAL-TR-2002-001; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Techniques for the preprocessing of quadratic programs are discussed. Most of the procedures extend known ones from the linear to quadratic cases, but a few new preprocessing techniques are introduced. The implementation aspects are also discussed. Numerical results are finally presented to indicate the potential of the resulting code, both for linear and quadratic problems. The impact of insisting that bounds of the variables in the reduced problem be as tight as possible rather than allowing some slack in these bounds is also shown to be numerically significant.

NTIS

Quadratic Programming; Preprocessing

20020070281 NASA Ames Research Center, Moffett Field, CA USA

A Domain-Decomposed Multi-Level Method for Adaptively Refined Cartesian Grids with Embedded Boundaries

Aftosmis, M. J., NASA Ames Research Center, USA; Berger, M. J., New York Univ., USA; Adomavicius, G., New York Univ., USA; Oct. 08, 1998; 1p; In English; 14th AIAA Computational Fluid Dynamics Conference on Parallel Computing, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 509-10-11; No Copyright; Avail: Issuing Activity; Abstract Only

The work presents a new method for on-the-fly domain decomposition technique for mapping grids and solution algorithms to parallel machines, and is applicable to both shared-memory and message-passing architectures. It will be demonstrated on the Cray T3E, HP Exemplar, and SGI Origin 2000. Computing time has been secured on all these platforms. The decomposition technique is an outgrowth of techniques used in computational physics for simulations of N-body problems and the event horizons of black holes, and has not been previously used by the CFD community. Since the technique offers on-the-fly partitioning, it offers a substantial increase in flexibility for computing in heterogeneous environments, where the number of available processors may not be known at the time of job submission. In addition, since it is dynamic it permits the job to be repartitioned without global communication in cases where additional processors become available after the simulation has begun, or in cases where dynamic mesh adaptation changes the mesh size during the course of a simulation. The platform for this partitioning strategy is a completely new Cartesian Euler solver tarcreted at parallel machines which may be used in conjunction with Ames' "Cart3D" arbitrary geometry simulation package.

Author

Computerized Simulation; Decomposition; Mapping; Algorithms; Computational Grids

20020070374 NASA Ames Research Center, Moffett Field, CA USA

Legacy Code Modernization

Hribar, Michelle R., MRJ Technology Solutions, Inc., USA; Frumkin, Michael, NASA Ames Research Center, USA; Jin, Haoqiang, MRJ Technology Solutions, Inc., USA; Waheed, Abdul, MRJ Technology Solutions, Inc., USA; Yan, Jerry, MRJ Technology Solutions, Inc., USA; [1998]; 1p; In English; SuperComputing 1998, 9-12 Nov. 1998, Orlando, FL, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

Over the past decade, high performance computing has evolved rapidly; systems based on commodity microprocessors have been introduced in quick succession from at least seven vendors/families. Porting codes to every new architecture is a difficult problem; in particular, here at NASA, there are many large CFD applications that are very costly to port to new machines by hand. The LCM ("Legacy Code Modernization") Project is the development of an integrated parallelization environment (IPE) which performs the automated mapping of legacy CFD (FORTRAN) applications to state-of-the-art high performance computers. While

most projects to port codes focus on the parallelization of the code, we consider porting to be an iterative process consisting of several steps: 1) code cleanup, 2) serial optimization, 3) parallelization, 4) performance monitoring and visualization, 5) intelligent tools for automated tuning using performance prediction and 6) machine specific optimization. The approach for building this parallelization environment is to build the components for each of the steps simultaneously and then integrate them together. The demonstration will exhibit our latest research in building this environment: 1. Parallelizing tools and compiler evaluation. 2. Code cleanup and serial optimization using automated scripts 3. Development of a code generator for performance prediction 4. Automated partitioning 5. Automated insertion of directives. These demonstrations will exhibit the effectiveness of an automated approach for all the steps involved with porting and tuning a legacy code application for a new architecture.

Author

Computer Aided Mapping; Performance Prediction; Commodities; Computer Programs; Evaluation

20020070462 Defence Science and Technology Organisation, Salisbury, Australia

A Proposed Reference Model Framework for the Application of Computer-Based Visualisation Approaches

Vernik, Rudi, Defence Science and Technology Organisation, Australia; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 17-1 - 17-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This presentation provides an overview of a reference model framework (called RM-Vis) being developed by the TTCP Action Group on Information Visualisation to provide the foundations for the various survey and analysis activities being undertaken by the group. A key feature of the framework is that it helps characterize visualization solutions in terms of their context of use, the visual representation and enhancement techniques used, and key features of tool support provided, such as user interactions, and deployment support. Initial tool support has been developed and is being used for the characterization, identification, and showcasing of visualization solutions in the C3I (Command, Control, Communications, Intelligence) domain. Various taxonomies and models have been proposed to support the characterization of visualization approaches. However, most have focused on defining visualization tools in terms of the types of data that can be visualized or specific techniques such as interaction modes, and particular domains of interest to the authors, such as software visualization. For example, it is rare to find taxonomies which characterize visualization approaches in terms of specific tasks that need to be performed by users (i.e. the domain context) or the types of things that need to be described (descriptive aspects). One exception is the IST-05 Reference Model for Visualisation developed by the NATO (North Atlantic Treaty Organization) group RTO (Research and Technology Organization) IST-013/ RTG-002. This model sets the context for computer-based visualization by considering the why, what, and how of visualization. The "why" relates to the needs of the human in terms of the tasks being undertaken (e.g. understanding, acting). The "what" refers to what information in the dataspace is important in terms of the visualization process (i.e. what needs to be described and what data are available to provide this description). The model refers to the "how" as being the engines (e.g. computer support) that allows humans to access, manipulate, and display the data.

Author

Scientific Visualization; Information Systems; Computer Techniques

20020070545 Vanderplaats Research and Development, Inc., Colorado Springs, CO USA

Very Large Scale Optimization

Vanderplaats, Garrett, Vanderplaats Research and Development, Inc., USA; August 2002; 55p; In English

Contract(s)/Grant(s): NAS1-00102; RTOP 253-02-98-01

Report No.(s): NASA/CR-2002-211768; NAS 1.26:211768; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this research under the NASA Small Business Innovative Research program was to develop algorithms and associated software to solve very large nonlinear, constrained optimization tasks. Key issues included efficiency, reliability, memory, and gradient calculation requirements. This report describes the general optimization problem, ten candidate methods, and detailed evaluations of four candidates. The algorithm chosen for final development is a modern recreation of a 1960s external penalty function method that uses very limited computer memory and computational time. Although of lower efficiency, the new method can solve problems orders of magnitude larger than current methods. The resulting BIGDOT software has been demonstrated on problems with 50,000 variables and about 50,000 active constraints. For unconstrained optimization, it has solved a problem in excess of 135,000 variables. The method includes a technique for solving discrete variable problems that finds a "good" design, although a theoretical optimum cannot be guaranteed. It is very scalable in that the number of function and gradient evaluations does not change significantly with increased problem size. Test cases are provided to demonstrate the efficiency and reliability of the methods and software.

Author

Very Large Scale Integration; Software Engineering; Algorithms; Multidisciplinary Design Optimization; Nonlinearity

20020070550 Argonne National Lab., IL USA

System Administrator's Manual (SAM) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Instance Segment Version 8.1.0.0 for Solaris 7

Feb. 26, 2002; 32p; In English

Report No.(s): DE2002-793101; No Copyright; Avail: Department of Energy Information Bridge

This document is the System Administrators Manual (SAM) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Instance Segment. It covers errors that can arise during the segments installation and deinstallation, and it outlines appropriate recovery actions. It also tells how to change the password for the SYSTEM account of the database instance after the instance is created, and it discusses the creation of a suitable database instance for ELIST by means other than the installation of the segment. The latter subject is covered in more depth than its introductory discussion in the Installation Procedures (IP) for the Enhanced Logistics Intratheater Support Tool (ELIST) Global Data Segment, Database Instance Segment, Database Fill Segment, Database Segment, Database Utility Segment, Software Segment, and Reference Data Segment (referred to in portions of this document as the ELISTIP).

NTIS

Computer Information Security; Data Bases; Logistics

20020070571 Argonne National Lab., IL USA

Software Version Description (SVD) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Fill Segment Version 8.1.0.0 for Solaris 7

Feb. 26, 2002; 32p; In English

Report No.(s): DE2002-793100; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document is the Software Version Description (SVD) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Fill Segment. It contains basic information about the segment.

NTIS

Data Bases; Logistics

20020070572 Argonne National Lab., IL USA

Software Version Description (SVD) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Segment Version 8.1.0.0 for Solaris 7

Feb. 26, 2002; 46p; In English

Report No.(s): DE2002-793099; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document is the Software Version Description (SVD) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Segment. It contains basic information about the segment. The ELIST Database Segment is one of seven segments that make up the DII COE ELIST mission application. The distributed segment software, data, and documentation are unclassified.

NTIS

Computer Programs; Data Bases; Logistics

20020070576 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Requirements for Linux Checkpoint/Restart

Feb. 26, 2002; 26p; In English

Report No.(s): DE2002-793773; LBNL-49659; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document has 4 main objectives: (1) Describe data to be saved and restored during checkpoint/restart; (2) Describe how checkpoint/restart is used within the context of the Scalable Systems environment, and MPI applications; (3) Identify issues for a checkpoint/restart implementation; and (4) Sketch the architecture of a checkpoint/restart implementation.

NTIS

Operating Systems (Computers); UNIX (Operating System); Architecture (Computers)

20020070586 Argonne National Lab., IL USA

System Administrator's Manual (SAM) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Segment Version 8.1.0.0 for Solaris 7

Feb. 26, 2002; 36p; In English

Report No.(s): DE2002-42293; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document is the System Administrator's Manual (SAM) for the Enhanced Logistics Intratheater Support Tool (ELIST) Database Segment. It covers errors that can arise during the segment's installation and deinstallation, and it outlines appropriate

recovery actions. It also tells how to extend the database storage available to Oracle if a datastore becomes filled during the use of ELIST. The latter subject builds on some of the actions that must be performed when installing this segment, as documented in the Installation Procedures (IP) for the Enhanced Logistics Intratheater Support Tool (ELIST) Global Data Segment, Database Instance Segment, Database Fill Segment, Database Segment, Database Utility Segment, Software Segment, and Reference Data Segment (referred to in portions of this document as the ELIST IP).

NTIS

Logistics; Data Bases; Installing; Data Storage

20020070673 National Inst. of Standards and Technology, Analytical Chemistry Div., Gaithersburg, MD USA

SpectroML An Extensible Markup Language for the Interchange of Molecular Spectrometry Data

Ruehl, M. A.; Schaefer, R.; Kramer, G. W.; Apr. 2002; 86p; In English

Report No.(s): PB2002-106320; NISTIR-6821; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: Introduction; UV/Vis Formats and the Way to SpectroML; Structure of SpectroML; SpectroML Elements; SpectroML Files; SpectroML Applications; Conclusion; References; Appendix A: Analysis of Existing UV/Vis Data Formats; Appendix B: A Short Introduction to XML; Appendix C: SpectroML Code.

NTIS

Programming Languages; Document Markup Languages; Molecular Spectroscopy

62

COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.

20020067757 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Documenting Software Architecture: Documenting Interfaces Final Report

Bachmann, Felix; Bass, Len; Clements, Paul; Garlan, David; Ivers, James; Jun. 2002; 47p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A403788; CMU/SEI-2002-TN-015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the fourth in a series of SEI reports on documenting software architectures. This report details guidance for documenting the interfaces to software elements. It prescribes a standard organization (template) for recording semantic as well as syntactic information about an interface. Stakeholders of interface documentation are enumerated, available notations for specifying interfaces are described, and three examples are provided.

DTIC

Templates; Architecture (Computers); Computer Program Integrity

20020067786 NASA Ames Research Center, Moffett Field, CA USA

A Data Miner for the Information Power Grid

Hinke, Thomas H., NASA Ames Research Center, USA; Jun. 13, 2002; 25p; In English; Global Grid Forum, 19-17 Jul. 2002, Edinburgh, Scotland, UK

Contract(s)/Grant(s): RTOP 704-40-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Grid Miner (GM) is one of the early data mining applications developed by NASA to help users obtain information from the Information Power Grid (IPG). Topics cover include: benefits of data mining, potential use of grids in data mining activities, an overview of the GM application, and a brief review of GM architecture and implementation issues. The current status of the GM system is also discussed.

CASI

Data Mining; Applications Programs (Computers); Computational Grids

20020067797 Department of Defense, Office of the Inspector General, Arlington, VA USA

Information System Security: DoD Web Site Administration, Policies, and Practices

Jul. 19, 2002; 28p; In English

Report No.(s): AD-A403984; IG/DOD-D-2002-129; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this audit was to evaluate policies and practices for Web site administration and oversight at selected DoD agencies. Specifically, we reviewed how the Defense Logistics Agency; the General Counsel, Office of the Secretary of Defense;

and the U.S. Space Command host official Web sites, and how the DoD agencies register the Web sites, monitor compliance with policy, and safeguard information displayed. In addition, we reviewed the DoD process for identifying and removing inappropriate information from publicly accessible DoD Web sites. The management control program as it relates to the overall objective was evaluated also.

DTIC

Internets; Security; Information Systems; Policies; Procedures

20020068383 Naval Research Lab., Ocean Sciences Branch, Bay Saint Louis, MS USA

Parallel Implementation of the QUODDY 3-D Finite-Element Circulation Model

Campbell, Timothy J.; Blain, Cheryl A.; Jun. 28, 2002; 33p; In English

Report No.(s): AD-A403939; NRL/FR/7320--02-10; 021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the implementation of the QUODDY finite-element circulation model on shared-memory multiprocessor computers using OpenMP. Because all code modifications were restricted to the main computational routines and no changes are required in the user interface and configuration files, the parallel code can be seamlessly integrated into existing regional applications of the model. Bit-for-bit matching between serial and parallel execution has been achieved. The code modifications reduced the execution time per model time step of one test case from 21.1 s on a single processor to about 1.4 s on 32 processors. by reducing turnaround time and enabling substantial increases in model resolution, the parallel code will benefit further coastal ocean model development.

DTIC

Mathematical Models; Computer Programming; Finite Element Method; Parallel Processing (Computers)

20020068385 Strathclyde Univ., Dept. of Computer and Information Sciences, Glasgow, UK

An Investigation into Component Reconfigurability Management for Dependable Ad-Hoc Networking *Final Report, 29 Sep. 2000 - 29 Sep. 2001*

Nixon, Paddy; Mar. 14, 2002; 23p; In English; Original contains color images

Contract(s)/Grant(s): F61775-00-WE044

Report No.(s): AD-A403963; EOARD-SPC-00-4044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Strathclyde to investigate requirements for robust reliable application communications in ad-hoc distributed mobile computer networks. Specifically, the contractor will investigate code mobility in ad-hoc collaborations and apply his insights into dynamic fault tolerant binding to the management of reliability. to implement and evaluate these issues, a heterogeneous, mobile, reconfigurable computer network will be assembled. This network will provide the required computational and physical mobility and will consist of hand-held computers and more powerful development laptop computers supported by a wireless Ethernet system (based on Lucent's WaveLan technology). Details of the deliverable are described below.

DTIC

Data Processing; Computer Networks; Reconfigurable Hardware; Distributed Processing; Fault Tolerance

20020070467 Emfisys, Toronto, Ontario Canada

Visualizing Expert Networks

Garigue, Robert, Emfisys, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 22-1; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

There are various ways of visualizing expert networks. One such way is to visualize social relationships among people. There are different objectives for getting people to disagree to get different viewpoints vs. getting people to get along. There is, finally, a greater need than simply the identification of people.

CASI

Information Management; Telecommunication; Scientific Visualization

CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.

20020067770 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

Extended Kalman Filter Sensor Fusion Signals of Nonlinear Dynamic Systems

Jassemi-Zargani, Rahim; Necsulescu, D. S.; Dec. 2001; 33p; In English; Original contains color images

Report No.(s): AD-A403794; DREO-TR-2001-155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

World modeling for achieving operational space motion control of robot arms requires accurate measurements of positions and velocities in both joint and operational space. Servomotors used for joint actuation are normally equipped with position sensors and, optionally, with velocity sensors for interlink motion measurements. Further improvements in measurement accuracy can be obtained by equipping the robot arm with accelerometers for absolute acceleration measurement. In this report an Extended Kalman Filter is used for multi-sensor fusion. The real-time control algorithm was previously based on the assumption of a jerk represented as a white noise process with zero mean. In reality, the accelerations are varying in time during the arm motion and the zero mean assumption is not valid, particularly during periods of fast acceleration. In this report, a model predictive control approach is used for predetermining next-time-step jerk such that the remaining term can be modeled as Gaussian white noise. Experimental results illustrate the effectiveness of the proposed sensor fusion approach.

DTIC

Kalman Filters; Nonlinear Systems; Robotics; Multisensor Fusion

20020068136 NASA Ames Research Center, Moffett Field, CA USA

On Abstractions and Simplifications in the Design of Human-Automation Interfaces

Heymann, Michael, Israel Inst. of Tech., Israel; Degani, Asaf, NASA Ames Research Center, USA; June 2002; 20p; In English
Contract(s)/Grant(s): NCC2-798; RTOP 548-40-12

Report No.(s): NASA/TM-2002-211397; IH-024; NAS 1.15:211397; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report addresses the design of human-automation interaction from a formal perspective that focuses on the information content of the interface, rather than the design of the graphical user interface. It also addresses the issue of the information provided to the user (e.g., user-manuals, training material, and all other resources). In this report, we propose a formal procedure for generating interfaces and user-manuals. The procedure is guided by two criteria: First, the interface must be correct, that is, with the given interface the user will be able to perform the specified tasks correctly. Second, the interface should be succinct. The report discusses the underlying concepts and the formal methods for this approach. Two examples are used to illustrate the procedure. The algorithm for constructing interfaces can be automated, and a preliminary software system for its implementation has been developed.

Author

Human-Computer Interface; User Manuals (Computer Programs); Education

20020069104 National Aerospace Lab., Amsterdam Netherlands

Mission Preparation and Training Facility for the European Robotic Arm (ERA)

Pronk, Z.; Schoonmade, M.; Jun. 1999; 14p; In English

Report No.(s): PB2002-105872; NLR-TP-99248; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 2000 the European Robotic Arm (ERA) will be launched and attached to the Russian segment of International Space Station Alpha. The arm will initially be used to support assembly operations on the Russian segment, and will eventually be used as servicing tool for at least ten years during Space Station life cycle. The Mission Preparation and Training Equipment (MPTE) is an important part of the ERA project. ERA operations will be prepared, planned, and supported from the MPTE, and ERA operators will be trained with the MPTE. Three identical versions of the MPTE will be installed at RSC/Energia-MCC and at the Gagarin Cosmonaut Training Centre in Russia, and at ESA/ESTEC in the Netherlands. Each of the facilities has its particular function in support of ERA operations, training, and maintenance. The design of the MPTE is based on existing tools and facilities to a maximum extent. Re-use is made of the real-time operations simulation facility EUROSIM, including the Image Generation Subsystem (IGS), and of the Columbus Ground Software system (CGS). Also, re-use is made of developments from the ERA projects, both hardware and software.

NTIS

Robot Arms; International Space Station; Computerized Simulation; Maintenance Training; Astronaut Training

20020069122 NASA Ames Research Center, Moffett Field, CA USA

A More Accurate Characterization of UH-60A Pitch Link Loads Using Neural Networks

Kottapalli, Sesi, NASA Ames Research Center, USA; [1998]; 4p; In English

Contract(s)/Grant(s): RTOP 581-20-22; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A more accurate, neural-network-based characterization of the full-scale UH-60A maximum, vibratory pitch link loads (MXVPLL) was obtained. The MXVPLL data were taken from the NASA/Army UH-60A Airloads Program flight test database. This database includes data from level flights, and both simple and "complex" maneuvers. In the present context, a complex maneuver was defined as one which involved simultaneous, non-zero aircraft angle-of-bank (associated with turns) and aircraft pitch-rate (associated with a pull-up or a push-over). The present approach combines physical insight followed by the neural networks application. Since existing load factors do not represent the above-defined complex maneuver, a new, combined load factor ('present-load-factor') was introduced. A back-propagation type of neural network with five inputs and one output was used to characterize the UH-60A MXVPLL. The neural network inputs were as follows: rotor advance ratio, aircraft gross weight, rotor RPM, air density ratio, and the present-load-factor. The neural network output was the maximum, vibratory pitch link load (MXVPLL). It was shown that a more accurate characterization of the full-scale flight test pitch link loads can be obtained by combining physical insight with a neural-network-based approach.

Author

Aerodynamic Loads; Neural Nets; Structural Weight; Vibratory Loads; UH-60A Helicopter

20020070280 NASA Ames Research Center, Moffett Field, CA USA

Integration of the Remote Agent for the NASA Deep Space One Autonomy Experiment

Dorais, Gregory A., NASA Ames Research Center, USA; Bernard, Douglas E., NASA Ames Research Center, USA; Gamble, Edward B., Jr., NASA Ames Research Center, USA; Kanefsky, Bob, NASA Ames Research Center, USA; Kurien, James, NASA Ames Research Center, USA; Muscettola, Nicola, NASA Ames Research Center, USA; Nayak, P. Pandurang, NASA Ames Research Center, USA; Rajan, Kanna, NASA Ames Research Center, USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes the integration of the Remote Agent (RA), a spacecraft autonomy system which is scheduled to control the Deep Space 1 spacecraft during a flight experiment in 1999. The RA is a reusable, model-based autonomy system that is quite different from software typically used to control an aerospace system. We describe the integration challenges we faced, how we addressed them, and the lessons learned. We focus on those aspects of integrating the RA that were either easier or more difficult than integrating a more traditional large software application because the RA is a model-based autonomous system. A number of characteristics of the RA made integration process easier. One example is the model-based nature of RA. Since the RA is model-based, most of its behavior is not hard coded into procedural program code. Instead, engineers specify high level models of the spacecraft's components from which the Remote Agent automatically derives correct system-wide behavior on the fly. This high level, modular, and declarative software description allowed some interfaces between RA components and between RA and the flight software to be automatically generated and tested for completeness against the Remote Agent's models. In addition, the Remote Agent's model-based diagnosis system automatically diagnoses when the RA models are not consistent with the behavior of the spacecraft. In flight, this feature is used to diagnose failures in the spacecraft hardware. During integration, it proved valuable in finding problems in the spacecraft simulator or flight software. In addition, when modifications are made to the spacecraft hardware or flight software, the RA models are easily changed because they only capture a description of the spacecraft. one does not have to maintain procedural code that implements the correct behavior for every expected situation. On the other hand, several features of the RA made it more difficult to integrate than typical flight software. For example, the definition of correct behavior is more difficult to specify for a system that is expected to reason about and flexibly react to its environment than for a traditional flight software system. Consequently, whenever a change is made to the RA it is more time consuming to determine if the resulting behavior is correct. We conclude the paper with a discussion of future work on the Remote Agent as well as recommendations to ease integration of similar autonomy projects.

Author

Applications Programs (Computers); Autonomy; Computer Systems Programs; Flight Control; Deep Space; Remote Control

20020070287 NASA Ames Research Center, Moffett Field, CA USA

Autonomous Rovers for Human Exploration of Mars

Bresina, John, NASA Ames Research Center, USA; Dorais, Gregory, NASA Ames Research Center, USA; Golden, Keith, NASA Ames Research Center, USA; Washington, Richard, NASA Ames Research Center, USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Autonomous rovers are a critical element for the success of human exploration of Mars. The robotic tasks required for human presence on Mars are beyond the ability of current rovers; these tasks include emplacement and maintenance of a habitat, fuel production facility, and power generator, landing-site scouting, and mining. These tasks are required before and also during human presence; the ability of rovers to offload work from the human explorers will enable the humans to accomplish their mission. The capacity for these tasks will be realized by significant advancement toward full rover autonomy and, in particular, by overcoming current rover mission limitations in the areas of robust operation, resource utilization, and failure recovery. The Pathfinder mission demonstrated the potential for robotic Mars exploration, but at the same time indicated clearly the need for more rover autonomy. The highly interactive, ground-intensive control with significant downtime limited the effectiveness of the Sojourner rover. Advances in rover offer increased rover productivity without risk to rover safety. We are developing an integrated on-board executive architecture that incorporates robust operation, resource utilization, and failure recovery. This work draws from our experience with the architecture for the Deep Space One autonomy experiment, with enhancements in the area of ensuring robust operation in the face of unpredictable, complex environments, such as what a rover encounters on Mars. Our ultimate goal is to provide a complete agent architecture for rover autonomy. The complete architecture will include long-range mission and path planning, self-diagnosis and fault recovery, and continual monitoring and adjustment of execution resources. The architecture will enable robust operation over long ranges of time and distance, performing complex tasks in a planned and opportunistic manner, and serving as an intelligent, capable tool for human explorers.

Author

Diagnosis; Ground Based Control; Interactive Control; Mars Exploration; Robotics; Roving Vehicles; Trajectory Planning

64

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20020067765 Arizona Univ., Optical Sciences Center, Tucson, AZ USA

Reconstruction Algorithms for MWIR Chromotomography Final Report, 10 Jun. 1999-10 Jun 2000

Garcia, J. P.; Aug. 2000; 33p; In English

Report No.(s): AD-A403740; AFRL-SN-HS-TR-2000-010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two methods of chromotomographic reconstruction applicable to the MWIR region of the electromagnetic spectrum were investigated. The first method involved the decomposition of the datacube into principal component space using the center order, broadband image to form and estimate the spatial components. Then this estimate was used to deconvolve an estimate of the spectral components. The second method used an extension of the traditional maximum-likelihood approach to suppress signal-independent noise in reconstructions of simulated low background scenes.

DTIC

Algorithms; Electromagnetic Spectra; Tomography; Image Reconstruction

20020068071 Naval Academy, Annapolis, MD USA

Modeling Morphogenesis with Reaction-Diffusion Equations using Galerkin Spectral Methods

Heineike, Benjamin M.; May 06, 2002; 89p; In English; Original contains color images

Report No.(s): AD-A403766; 296-(2002); No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This project studies the nonhomogeneous steady-state solutions of the Gray-Scott model, a system of nonlinear partial differential equations that has received attention in the past decade in the context of pattern formation and morphogenesis. Morphogenesis, or birth of shape, is the biological term for the initial formation of patterns that occur in development as cells begin to differentiate. The model is a two morphogen reaction-diffusion system in which individual molecules display complex self-organization in aggregate. The project is divided into two main parts. The first part develops the Galerkin Spectral method for application to the two species reaction-diffusion system. Limitations and capabilities of the Galerkin Spectral method are discussed in the context of the heat equation, the Burgers equation, and the Allen-Cahn equation. The second part analyzes the stability of equilibria in the Gray-Scott model in terms of reaction and diffusion parameters. A region of Hopf bifurcation is identified for the diffusionless system, and conditions for diffusion driven instability are developed. We show in particular that diffusion driven instability will occur only when the diffusion constants of each morphogen are different in any two species reaction-diffusion equation. We then show some numerical simulations of pattern formation in the Gray-Scott model using MATLAB programs to implement the Galerkin Spectral method.

DTIC

Mathematical Models; Partial Differential Equations; Reaction-Diffusion Equations; Galerkin Method; Spectral Methods

20020068961 Argonne National Lab., IL USA

Making Automatic Differentiation Truly Automatic: Coupling PETSc with ADIC

Hovland, P.; Norris, B.; Smith, B.; 2002; 14p; In English

Report No.(s): DE2002-41723; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Despite its name, automatic differentiation (AD) is often far from an automatic process. Often one must specify independent and dependent variables, indicate the derivative quantities to be computed, and perhaps even provide information about the structure of the Jacobians or Hessians being computed. However, when AD is used in conjunction with a toolkit with well-defined interfaces, many of these issues do not arise. They describe recent research into coupling the ADIC automatic differentiation tool with PETSc, a toolkit for the parallel numerical solution of PDEs. This research leverages the interfaces and objects of PETSc to make the AD process very nearly transparent.

NTIS

Differential Calculus; Dependent Variables; Transparency

20020069131 MCAT Inst., Moffett Field, CA USA

Numerical Experiment with Time and Spatial Accuracy of Navier-Stokes Computation For Helicopter Problems

Ahmad, Jasim, MCAT Inst., USA; Oct. 14, 1998; 11p; In English; 17th AIAA Applied Aero Conference, 28 Jun. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS2-14109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Helicopter flowfields are highly unsteady, nonlinear and three-dimensional. In forward flight and in hover, the rotor blades interact with the tip vortex and wake sheet developed by either itself or the other blades. This interaction, known as blade-vortex interactions (BVI), results in unsteady loading of the blades and can cause a distinctive acoustic signature. Accurate and cost-effective computational fluid dynamic solutions that capture blade-vortex interactions can help rotor designers and engineers to predict rotor performance and to develop designs for low acoustic signature. Such a predictive method must preserve a blade's shed vortex for several blade revolutions before being dissipated. A number of researchers have explored the requirements for this task. This paper will outline some new capabilities that have been added to the NASA Ames' OVERFLOW code to improve its overall accuracy for both vortex capturing and unsteady flows. To highlight these improvements, a number of case studies will be presented. These case studies consist of free convection of a 2-dimensional vortex, dynamically pitching 2-D airfoil including light-stall, and a full 3-D unsteady viscous solution of a helicopter rotor in forward flight. In this study both central and upwind difference schemes are modified to be more accurate. Central difference scheme is chosen for this simulation because the flowfield is not dominated by strong shocks. The feature of shock-vortex interaction in such a flow is less important than the dominant blade-vortex interaction. The scheme is second-order accurate in time and solves the thin-layer Navier-Stokes equations in fully-implicit manner at each time-step. The spatial accuracy is either second and fourth-order central difference or third-order upwind difference using Roe-flux and MUSCLE scheme. This paper will highlight and demonstrate the methods for several sample cases and for a helicopter rotor. Preliminary computations on a rotor were performed by using this method and are in the process of documentation.

Author

Helicopters; Rotors; Blade-Vortex Interaction; Upwind Schemes (Mathematics); Unsteady Flow; Computerized Simulation

65

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.

20020068068 Corps of Engineers, Washington, DC USA

Engineering and Design: Uncertainty Estimates for Nonanalytic Frequency Curves

Stockton, Steven L.; Oct. 31, 1997; 12p; In English

Report No.(s): AD-A403773; USACE-ETL-1110-2-537; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This letter presents a methodology for computing the uncertainty about nonanalytic frequency curves. This situation arises when estimating flow-frequency curves from hypothetical events regulated frequency curves and stage-frequency curves. The method involves the application of order statistics to compute the uncertainty distribution.

DTIC

Asymptotic Properties; Methodology; Frequencies; Uncertain Systems; Design Analysis

20020068080 Case Inst. of Tech., Cleveland, OH USA

Exact Power of Some Two-Sample and C-Sample Non-Parametric Statistical Procedures

Haynam, George E.; Jan. 1962; 110p; In English

Contract(s)/Grant(s): AF-AFOSR-62-78

Report No.(s): AD-A403875; AFOSR-3164; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Expressions for the exact power of the two-sample Mann-Whitney Wilcoxon U test procedure against alternatives of exponential and rectangular populations have been derived. Several examples for total sample sizes of 11 and 15 have been compared with Mood's median test. Mood's test is more powerful than the U test in all instances in which the number of observations from the null population exceeds the number from the alternative population. The converse is true when the number of observations from the null population is less than the number from the alternative. Expressions for the asymptotic efficiency of the Mann-Whitney-Wilcoxon U test relative to Mood's and Massey's tests and the likelihood ratio test have been derived for exponential populations. The asymptotic efficiency of the U test relative to the likelihood ratio test is zero. Mood's and Massey's test procedures for two samples have been extended to the case of discriminating among c populations on the basis of c ordered samples. Expressions for the exact power have been derived for Mood's test with exponential and rectangular populations and for Massey's test with exponential populations. With exponential translation alternatives, the tests are biased. The exact null distributions of goodness of fit tests for one-way and two-way contingency tables indicate that even for samples as small as ten, the exact distribution is closely approximated by a chi-square distribution with the appropriate degrees of freedom.

DTIC

Nonparametric Statistics; Mann-Whitney-Wilcoxon U Test

20020068823 College of New Jersey, Dept. of Mathematics and Statistics, Pomona, NJ USA

An Overview of PRA with Applications to Aerospace Systems

Navard, Sharon E., College of New Jersey, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXIV-1 - XXXIV-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Probabilistic Risk Assessment (PRA) is a systematic process for evaluating the probabilities and consequences of undesirable events that can occur in a process or system along with providing a measure of the uncertainty associated with these probability estimates. In the past it was looked at with suspicion by many at NASA, perhaps because of bad experiences with unsuccessful quantitative methods during the Apollo era, but since the Challenger accident NASA has mandated that it be used, and it has been very successful. With NASA's new "faster, better, cheaper" philosophy, it is vital that a tool be in place that can help to achieve these goals in the reliability area. This paper describes the history of PRA, gives examples of its aerospace applications to date, and gives suggestions for how it can be used in the future, both for space shuttle upgrades and for totally new technologies such as the Second Generation Reusable Launch Vehicle.

Author

Assessments; Probability Theory; Risk

20020068957 NASA Ames Research Center, Moffett Field, CA USA

Making the Impossible Possible: Strategies for Fast POMDP Monitoring

Washington, Richard, NASA Ames Research Center, USA; [1998]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Systems modeled as partially observable Markov decision processes (POMDPs) can be tracked quickly with three restrictions: all actions are grouped together, the out-degree of each system state is bounded by a constant, and the number of non-zero elements in the belief state is bounded by a (different) constant. With these restrictions, the tracking algorithm operates in constant time and linear space. The first restriction assumes that the action itself is unobservable. The second restriction defines a subclass of POMDPs that covers however a wide range of problems. The third restriction is an approximation technique that can lead to a potentially vexing problem: an observation may be received that has probability according to the restricted belief state. This problem of impossibility will cause the belief state to collapse. In this paper we discuss the tradeoffs between the constant bound on the belief state and the quality of the solution. We concentrate on strategies for overcoming the impossibility problem and demonstrate initial experimental results that indicate promising directions.

Author

Markov Processes; Systems Analysis; Numerical Analysis; Statistical Analysis; Probability Theory; Statistical Distributions

20020068962 Argonne National Lab., IL USA

Alternative Implementations of the Monte Carlo Power Method

Blomquist, R. N.; Gelbard, E. M.; Dec. 2001; 40p; In English

Report No.(s): DE2002-41688; ANL-01-41688; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We compare nominal efficiencies, i.e. variances in power shapes for equal running time, of different versions of the Monte Carlo eigenvalue computation, as applied to criticality safety analysis calculations. The two main methods considered here are 'conventional' Monte Carlo and the superhistory method, and both are used in criticality safety codes. Within each of these major methods, different variants are available for the main steps of the basic Monte Carlo algorithm. Thus, for example, different treatments of the fission process may vary in the extent to which they follow, in analog fashion, the details of real-world fission, or may vary in details of the methods by which they choose next-generation source sites. In general the same options are available in both the superhistory method and conventional Monte Carlo, but there seems not to have been much examination of the special properties of the two major methods and their minor variants. We find, first, that the superhistory method is just as efficient as conventional Monte Carlo and, secondly, that use of different variants of the basic algorithms may, in special cases, have a surprisingly large effect on Monte Carlo computational efficiency.

NTIS

Monte Carlo Method; Eigenvalues; Computation

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20020068832 Louisiana State Univ., Dept. of Industrial and Manufacturing Systems Engineering, Shreveport, LA USA

Operations Analysis of Space Shuttle System

Sarker, Bhaba R., Louisiana State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLVI-1 - XLVI-5; In English; Also announced as 20020068792

Contract(s)/Grant(s): NAG8-1786; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The space science program at NASA since 1950's has gone through stages of development and implementation in rocketry and scientific advancement. It has become the nation's largest scientific institution of research and innovation for space exploration and military research, and overall a pride of the nation at an exorbitant cost. After placing man on moon, space shuttle program at NASA is an on-going project with a high success rate at an average cost of about \$450m per flight. A future endeavor from both government and private sectors needs to be undertaken for commercialization of this expensive mission. In order to attract private enterprises, it needs to boost up its operations with better technology at lower cost to cope with rapid changes in scientific advancement and economic competition. Thus, a second-generation reusable launch vehicle (2GRLV) will play a major role in future operation of NASA centers. Envisioning this potential way of saving the program by reducing the cost, NASA is currently managing an innovative program called the Space Launch Initiative (SLI) to develop key technologies that will support the development of second-generation reusable launch vehicles (RLV) which will be more economical and safer and reliable than the existing space shuttle system. The selection of which technologies to fund for further development is being based on their likelihood to contribute to providing cost reduction or safety improvements. It is envisioned that in the 2006 timeframe, NASA will make a decision as to whether or not to commit to the replacement of the current space shuttle system with a new RLV. The decision to proceed with a new RLV will be partly based on the likelihood that the new system will be better than the existing space shuttle. Government and private entrepreneurs are currently considering four different types of RLV projects: commercial programs, government programs, international concepts, and X Prize competitors. NASA has already commissioned a series of X-programs to study the future RLV program. Today, NASA decision makers need analytical tools to help determine which technologies to fund the development of this technology. In the 2006 timeframe, these same decision makers will need analytical tools to evaluate and compare various RLV architectures, including the existing space shuttle so as to make the best decision for whether or not to proceed with the development of a new RLV, and if so, then which one. A study is conducted here to establish ground level knowledge from the historical data and expertise experiences of the field personnel. Such information is compiled in the form of mission statement, goals, space shuttle operations, payloads and cargo constraints, resource constraints, and bottlenecks to the enhancement vector.

Derived from text

Reusable Launch Vehicles; Research and Development; Space Shuttles; Assessments; Project Planning; Operations Research

20020070445 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
Multimedia Visualization of Massive Military Datasets *Atelier OTAN sur la Visualisation Multimedia d'Ensembles Massifs de Donnees Militaires*

Multimedia Visualization of Massive Military Datasets; August 2002; 118p; In English; Multimedia Visualization of Massive Military Datasets, 6-9 Jun. 2000, Quebec, Canada; Also announced as 20020070446 through 20020070472; CD-ROM contains full text document in PDF and PPS formats

Report No.(s): RTO-MP-050; AC/323(IST-020)TP/10; ISBN 92-837-1086-X; Copyright Waived; Avail: CASI; C01, CD-ROM; A06, Hardcopy; A02, Microfiche

The workshop on Multimedia Visualization of Massive Military Datasets was held at the Defence Research Establishment Valcartier, Quebec, Canada from 6-9 June 2000. Five major themes were addressed in 28 presentations with extended discussion, in separate sessions entitled: 1) Operations Visualization; 2) Visualization for Command; 3) Network Visualization; 4) Data Fusion; and 5) Maths and Techniques.

CASI

Multimedia; Scientific Visualization; Military Technology; Data Management; Multisensor Fusion; Software Engineering; Data Mining

20020070446 Horne (Barry), Llanmaes, UK

Visualising the Electronic Order of Battle

Horne, Barry, Horne (Barry), UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 1-1; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The Electronic Order of Battle (EOB) details all known combinations of emitters and platforms in a particular Area of Responsibility, for both Blue and Red force data. On today's modern battlefield an EOB can present a very complex and potentially confusing picture to the war fighter. Consequently, some method of presenting the EOB in a format readily assimilated by operators amongst the myriad data presented to them during pre-mission briefings is required. It is believed that visualisation techniques could be used to enhance the presentation of EOBs and assist operators to better understand and retain the data presented. The PowerPoint presentation comprises two parts: a brief description of how an EOB is produced and then a brief on how EOBs are currently presented.

Derived from text

Electronic Warfare; Missiles; Multimedia; Data Bases

20020070447 Air Force Research Lab., Rome, NY USA

Visualizing the Status of On-going Air Operations

Griffith, David A., Air Force Research Lab., USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 2-1; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

Air tasking orders are issued in context. Consistency with the master air defence plan (MADP) and the airspace coordination plan (ACP) is necessary. Moreover, there is a complex of factors and stakeholders that include but are not limited to the following: 1) Joint task force (JTF); 2) air operations Airspace control authority (ACA) 3) Joint force air component commander (JFACC); and 4) Area air defence commander (AADC).

Derived from text

Air Defense; Military Operations; Airspace; Video Communication

20020070448 Royal Air Force, Waddington, UK

Visualising the Status of On-going Air Operations

Bird, J., Royal Air Force, UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 3-1; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

A suggestion for improvement was to use software that would allow you to overlay different views on the 3D display. The level of detail was discussed.

Derived from text

Air Defense; Collision Parameters; Display Devices; Three Dimensional Models

20020070449 Defence Research Establishment Valcartier, Geospatial Systems Group, Val Belair, Quebec Canada

The Electronic Battle Box

Gouin, Denis, Defence Research Establishment Valcartier, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 4-1 - 4-6; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A02, Hardcopy

The Electronic Battle Box is an integrated suite of planning and decision-aid tools specially designed to facilitate Canadian Armed Force Officers during their training and during their tasks of preparing and conducting military operations. It is the result of a collaborative effort between the Defence Research Establishment Valcartier, the Directorate of Army Doctrine (DAD), the Directorate of Land Requirements (DLR), the G4 staff of 1Cdn Div HQ and CGI Information and Management Consultants Inc. Distributed on CD-ROM, the Electronic Battle Box contains efficient and user-friendly tools that significantly reduce the planning time for military operations and ensure staff officers a better focus on significant tasks. Among the tools are an OrBat Browser and an Equipment Browser allowing to view and edit military organizations, a Task Browser providing facilities to prepare plans using Gantt charts, a Logistic Planner allowing to estimate supply requirements applying complex calculations, and Road, Air and Rail Movement Planners. EBB also provides staff officers with a large set of doctrinal documents in an electronic format. This paper provides an overview of the various tools of the Electronic Battle Box.

Author

Military Operations; Electronic Warfare; Planning

20020070450 Taylor (Martin) Consulting, Toronto, Ontario Canada

Issues of Visualisation in Peacekeeping Operations

Taylor, M. M., Taylor (Martin) Consulting, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 5-1 - 5-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper notes a few of the multitude of problems that face officers involved in peacekeeping, which is an increasingly important part of the activities of most militaries. It is asserted that the officers could be helped by the provision of displays that could show them some of the relationships among individuals and groups that may be encountered during the operations. These relationships are of several types. They may be symmetric or asymmetric, and may be bilateral, trilateral, or possibly even more complex. Little is known about how to display relationships, especially complex relationships within large numbers of individuals and groups. It is asserted that however the relationships are best displayed individually, the display of large sets is likely to depend on some kind of fish-eye view, in which the most detailed information concerns a central individual or group, with more distant relationships shown in less detail.

Derived from text

Display Devices; Military Operations; Peacetime

20020070451 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Ergonomics and Information Systems Dept., Wachtberg-Werthoven, Germany

Support Concept for Creation and Use of Marine Doctrines: Problem Presentation

Kaster, Annette, Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Germany; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 6-1 - 6-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The aim of this research project is the development of an ergonomic support concept for creation and use of marine doctrines. Command and combat direction systems deal with decision making processes, which support operators in identification, classification and combat. These tasks can be optimized by means of variable parameters according to the situational environment. Special decision rules (doctrines) allow the value assignment to parameters according to specific events. Those rules allow the simplification of the operator interface and can influence significantly system behaviour. The task of this research project is to optimize the tools required for handling and visualizing doctrines and parameters rather than to develop doctrines in content. The user shall be relieved by the use of information processing and information presentation technologies. The effectiveness of the doctrine concept shall be assured.

Author

Data Processing; Command Guidance; Human Factors Engineering; Research and Development

20020070452 Defence Evaluation Research Agency, Malvern, UK

The Surveillance Picture Visualisation and Display

Tait, J., Defence Evaluation Research Agency, UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 7-1 - 7-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The aim of this paper is to outline some of the work carried out at DERA Malvern about visualisation and display issues associated with the surveillance picture. It will describe some of the current surveillance pictures in use in NATO, outline the application of symbology in the air picture, and then describe how visualization can help the identification officer.

Author

Surveillance; Display Devices; North Atlantic Treaty Organization (NATO); Images

20020070453 Visual Insights, Inc., Toronto, Ontario Canada

Environmental Visualization for Sonar Tactical Decision Aids

Wright, William, Visual Insights, Inc., Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 8-1 - 8-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The coverage and timeliness of environmental data is improving significantly. New analytical acoustical models offer increased resolution and greater accuracy. PC computing platforms are orders of magnitude faster. There is a need to turn a moderately slow environment assessment into a rapid environment assessment. Given near-complete environmental data and faster more accurate models, DERA recently posed the question of how can these capabilities be harnessed to improve the performance of ASW sonar operations and tactical decision making. How would this environmental data be displayed? Visualization is one tool that can be beneficial in presenting and exploiting the environmental picture. Visualization is a valuable tool anywhere there are large amounts of data, and/or multi-dimensional data, and/or the need for context and focus, and most importantly, where ever people need to be in the loop. Interactive 2D and 3D visualizations allow people to see more data, more quickly with more comprehension. Situation awareness, and decision-making processes can benefit from combining data, graphics and interaction. Understanding is increased, tasks are completed more quickly, critical data and analytical resources are fully used, confidence is increased and decisions are improved.

Derived from text

Decision Making; Mathematical Models; Sonar; Computer Graphics

20020070455 Defence Evaluation Research Agency, KIS Division, Malvern, UK

Joint Operations Picture

Bilsby, Liz, Defence Evaluation Research Agency, UK; Hines, Rose, Defence Evaluation Research Agency, UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 10-1 - 10-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper presents an overall picture of joint operations describing the problem, key purposes, functional requirements, profiling, and future issues.

CASI

Military Operations; Human Factors Engineering

20020070456 Mitre Corp., McLean, VA USA

Battlespace Visualisation

Gershon, N., Mitre Corp., USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 11-1 - 11-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

A discussion on Battlespace Visualization is presented.

CASI

Display Devices; Visual Signals

20020070457 Cunningham (William), Poquosow, VA USA

Visualizing Logistics

Cunningham, William, Cunningham (William), USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 12-1 - 12-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

Logistics processes can be divided into two categories: deployment and sustainment. Both categories generate huge and dynamic datasets that are difficult to comprehend without visualization products. My remarks will address deployment because that is where Argonne National Lab has placed its greatest effort with the simulations presented. Deployment can be viewed as a network flow conducted sequentially in three distinct stages, each of which generates its own oversupply of data to comprehend. The three stages consist of gathering or marshalling the force from its predeployment locations to ports of debarkation, movement of the force from ports of embarkation to ports of debarkation and then movement of the force from of debarkation to where needed. Simplistically, this can be called fan-in, transport and fan-out. All three stages are active simultaneously in a fully launched deployment, requiring reuse of assets and steady flow through transfer nodes.

Derived from text

Deployment; Logistics; Computerized Simulation

20020070458 Visual Insights, Inc., Toronto, Ontario Canada

Visualization for the Command Post of the Future

Wright, Bill, Visual Insights, Inc., Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 14-1 - 14-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

A set of limited objective experiments concerning the command post of the future (CPOF) were performed.

CASI

Display Devices; Military Operations; Human Factors Engineering

20020070459 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France

Performance Measurement for Visualisation

Hollands, J. G., Research and Technology Organization, France; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 14-1 - 14-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

Key problems with extant visualization systems for command and control (C2) are outlined. A systematic research program investigating five key issues relevant to C2 information visualization is proposed. The outcome of this work should help to improve our understanding of those factors that make C2 visualization more effective.

Author

Command and Control; Decision Making; Management Systems; Information Systems

20020070460 Defence Evaluation Research Agency, Malvern, UK

The Master Battle Planner

Richardson, G., Defence Evaluation Research Agency, UK; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 15-1 - 15-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The development of the MBP (Master Battle Planner) commenced as an investigation into novel HCIs (Human-Computer Interface), and has now been extended as a tool for Master Air Attack Plan production. As the system is PC (personal computer) based, minimal support is required and campaign planning can literally commence using a laptop in transit to the operational theatre.

Author

Personal Computers; Warfare; Military Technology; Mission Planning

20020070470 Defence Science and Technology Organisation, Salisbury, Australia

Assembly and Deployment of Enterprise Visualisation Solutions

Vernik, R., Defence Science and Technology Organisation, Australia; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 25-1 - 25-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This presentation gives a brief overview of the research that we are conducting into the use of computer based visualization in the C3I (Command, Control, Communications, Intelligence) domain.

Derived from text

Command and Control; Reconnaissance; Communication; Scientific Visualization

20020070471 Taylor (Martin) Consulting, Toronto, Ontario Canada

Sensor Deployment

Taylor, Martin, Taylor (Martin) Consulting, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 27-1 - 27-4; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

It seems somewhat inconsistent for a commander to complain about the dataflood, while at the same time asking for screens that fill whole room walls and can present ever more data. Yet this is exactly what many commanders do. This presentation discusses the underlying factors that resolve the seeming inconsistency. The Basic Question has two answers (both valid): 1. The more screen real estate, the more context of different kinds can be displayed for any item of focal interest; 2. Eyes "flick" more easily than screen data can be changed by interactive devices, meaning that both focus and context can be changed rapidly and consistently, with an easy return to the original focus and context once the information from the new place has been assimilated. An eye-flick is the simplest kind of sensor redeployment. But it is like any other sensor redeployment in that it provides information about a new part of the environment, while losing the ability to gather information from the place the sensor observed before the redeployment. One always must balance gains and losses when redeploying sensors, but the gains and losses are not simply the gain of the new scene and the loss of the old. One loss comes from the fact that the sensor is unusable during redeployment. Another loss comes from the resources needed to determine where the sensor should be moved, and to actually effect the move. In the case of the eye, it is often a peripherally observed movement or flash that tells you where to move the eye,

and the eye itself is a lightweight sphere in a well lubricated environment, meaning that the movement can be quick and accurate, using few processing resources to determine the target of the move, little muscle power to effect the move, and little loss of observing time during the move. In contrast to using an eye-flick, if the commander's display showed only the data relevant to the task at hand, sensor redeployment would require some processing to determine what new data to select, attention to perform the selection, and substantial time-loss during the change. A very large display, then, if the content is appropriately configured, can allow the user to substitute a very easy eye-flick sensor redeployment for the more complex method of instructing the computer to display the data that are newly of interest.

Derived from text

Eye (Anatomy); Display Devices; Surveillance; Remote Sensors; Human-Computer Interface

20020070472 Kunar (J.), Kanata, Ontario Canada

Pace of Change

Kunar, J., Kunar (J.), Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 28-1 - 28-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The advent of information technology has changed several fundamental ideas about progress. Optimization of established designs is not longer sufficient for organizations to advance, they must now utilize innovation, which often entails adopting untested strategies and technologies. The advancements in computational power have far reaching implications for organizations, especially those who rely on visualization.

CASI

Scientific Visualization; Technology Utilization; Technology Assessment; Armed Forces

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

20020067766 Universitaet der Bundeswehr Muenchen, Neubiberg Germany

Contact Detonations and Impact/Penetration Problems: Demonstration of a Procedure to Establish Guidelines for Reliable and Safe Numerical Simulations Final Report, 14 Jul. 2000-1 Apr. 2002

Gebbeken, F. N.; Ruppert, Max; Nov. 26, 2001; 102p; In English

Contract(s)/Grant(s): F61775-00-WE051

Report No.(s): AD-A403734; EOARD-SPC-00-4051; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

One goal of the research initiative is to foster both the correct commercial code development and its proper use for the benefit of research and technological development. The objectives are to: define the problem of software code verification and validation, define the problem of precision testing for software code verification and validation, establish guidelines for reliable and safe numerical simulations, develop standards for numerical simulations, and define qualifications and requirements for FE/FD-Code users. These objectives may hold in general, but in order to restricted time and money we will first focus on a well defined class of problems: Contact Detonations and Impact/Penetration Problems. This is a first necessary step towards the final goal of an international standard.

DTIC

Detonation; Computerized Simulation; Impact; Reliability Analysis

70

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

20020068008 NASA Ames Research Center, Moffett Field, CA USA

The Space-Time CE/SE Method for Solving Maxwell's Equations in Time-Domain

Wang, X. Y., Taitech, Inc., USA; Chen, C. L., Rockwell Scientific Co., LLC, USA; Liu, Yen, NASA Ames Research Center, USA; [2002]; 4p; In English; 2002 IEEE AP-S International Symposium, 16-21 Jun. 2002, San Antonio, TX, San Antonio, TX, USA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An innovative finite-volume-type numerical method named as the space-time conservation element and solution element (CE/SE) method is applied to solve time-dependent Maxwell's equations in this paper. Test problems of electromagnetics scattering and antenna radiation are solved for validations. Numerical results are presented and compared with the analytical solutions, showing very good agreements.

Author

Space-Time Ce/Se Method; Computational Fluid Dynamics; Maxwell Equation; Mathematical Models; Conservation

20020068944 NASA Ames Research Center, Moffett Field, CA USA

Spectral (Finite) Volume Method for Conservation Laws on Unstructured Grids II: Extension to Two Dimensional Scalar Equation

Wang, Z. J., Michigan State Univ., USA; Liu, Yen, NASA Ames Research Center, USA; Mar. 25, 2002; 51p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The framework for constructing a high-order, conservative Spectral (Finite) Volume (SV) method is presented for two-dimensional scalar hyperbolic conservation laws on unstructured triangular grids. Each triangular grid cell forms a spectral volume (SV), and the SV is further subdivided into polygonal control volumes (CVs) to supported high-order data reconstructions. Cell-averaged solutions from these CVs are used to reconstruct a high order polynomial approximation in the SV. Each CV is then updated independently with a Godunov-type finite volume method and a high-order Runge-Kutta time integration scheme. A universal reconstruction is obtained by partitioning all SVs in a geometrically similar manner. The convergence of the SV method is shown to depend on how a SV is partitioned. A criterion based on the Lebesgue constant has been developed and used successfully to determine the quality of various partitions. Symmetric, stable, and convergent linear, quadratic, and cubic SVs have been obtained, and many different types of partitions have been evaluated. The SV method is tested for both linear and non-linear model problems with and without discontinuities.

Author

Finite Volume Method; Unstructured Grids (Mathematics); Two Dimensional Models; Conservation Laws; Nonlinear Equations; Polynomials

20020069080 National Inst. of Standards and Technology, Gaithersburg, MD USA

Journal of Research of the National Institute of Standards and Technology, January/February 2002. Volume 107, No. 1

2002; 150p; In English

Report No.(s): PB2002-107641; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Contents include the following: Message From the Chief Editor; Articles; Data Analysis Methods for Synthetic Polymer Mass Spectrometry: Autocorrelation; Ultraviolet Spectroradiometers Including Narrowband Filter Radiometers; Electron-Impact Total Ionization Cross Sections of Hydrocarbon Ions; A Systematic Approach for Multidimensional, Closed-Form Analytic Modeling: Effective Intrinsic Carrier Concentrations in Ga_{1-x}Al_xAs Heterostructures; Quantitating Fluorescence Intensity from Fluorophore: The Definition of MESF Assignment; The State of the Art and Practice in Digital Preservation; Treasure of the Past X: A Spectroscopic Determination of Scattering Lengths for Sodium Atom Collisions; and News Briefs.

NTIS

Autocorrelation; Hydrocarbons; Electron Impact; Fluorescence

20020069097 National Aerospace Lab., Amsterdam Netherlands

Analysis of the Data from a Distributed Set of Accelerometers, for Reconstruction of Set Geometry and its Rigid Body Motion

Vreeburg, J. P. B.; Aug. 1999; 24p; In English

Report No.(s): PB2002-105861; NLR-TP-98343; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper reports on a current line of research in accelerometry. Two subjects are addressed: the reconstruction of the location and attitude of a linear, or uni-axial, accelerometer from its output under a known motion, and the reconstruction of the acceleration field constituent vectors from the combined output of a known arrangement of linear accelerometers. The arrangement can be arbitrary and, consequently, does not require precision mounting. The component of the acceleration along the sensitive direction gives the ideal output of the accelerometer. When the motion that induces the acceleration is known, a set of five ideal measurement data may suffice to recover the location and attitude of the accelerometer. The formulae for this calculation are given. Their use is illustrated by simulation of an accelerometer and its output. The effects of errors are shown; it is found that noisy data are much less detrimental to the reconstruction calculations than systematic errors in the known motion. If the geometry of a set of accelerometers is known, their output can be combined for the reconstruction of the linear and angular motion components that

induce the acceleration. Conventionally this is achieved by elimination of the contribution of the angular rate of the geometry to the acceleration field. Only special arrangements of accelerometers, discussed in the literature, allow elimination by elementary operations. A method, thought to be new, is presented for the elimination of the linear and angular acceleration contributions to the field sensed by an arbitrary arrangement of accelerometers, and the consequent recovery of the angular rate vector from the reduced data set. Particular difficulties are encountered in this process but it has been shown that successful reconstruction is possible when a redundant set of data is available. Various options are suggested for further analysis, with the goal to determine the minimum arrangement, identify system errors or improve data accuracy.

NTIS

Accelerometers; Angular Acceleration; Systematic Errors

20020070215 Rochester Univ., Lab. for Laser Energetics, NY USA

Simple Numerical Schemes for the Korteweg-deVries Equation

McKinstrie, C. J.; Kozlov, M. V.; Dec. 2000; 34p; In English

Report No.(s): DE2002-769392; LLE-315; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two numerical schemes, which simulate the propagation of dispersive nonlinear waves, are described. The first is a split-step Fourier scheme for the Korteweg-de Vries (KdV) equation. The second is a finite-difference scheme for the modified KdV equation. The stability and accuracy of both schemes are discussed. These simple schemes can be used to study a wide variety of physical processes that involve dispersive nonlinear waves.

NTIS

Korteweg-Devries Equation; Wave Propagation; Nonlinearity

20020070268 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Post-LHC Accelerator Magnets

Gourlay, S. A.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795367; LBNL-49903; SC-MAG-766; No Copyright; Avail: National Technical Information Service (NTIS)

The design and practicality of future accelerators, such as hadron colliders and neutrino factories being considered to supersede the LHC, will depend greatly on the choice of superconducting magnets. Various possibilities will be reviewed and discussed, taking into account recent progress and projected improvements in magnet design and conductor development along with the recommendations from the 2001 Snowmass workshop.

NTIS

Superconducting Magnets; Accelerators

20020070270 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Initial Test Results of an Ionization Chamber Shower Detector for a LHC Luminosity Monitor

2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-795340; No Copyright; Avail: National Technical Information Service (NTIS)

A novel segmented, multi-gap, pressurized gas ionization chamber is being developed for optimization of the luminosity of the LHC. The ionization chambers are to be installed in the front quadrupole and zero degree neutral particle absorbers in the high luminosity IRs and sample the energy deposited near the maxima of the hadronic/electromagnetic showers in these absorbers. The ionization chambers are instrumented with low noise, fast, pulse shaping electronics to be capable of resolving individual bunch crossings at 40MHz. In this paper we report the initial results of our second test of this instrumentation in an SPS external proton beam. Single 300GeV protons are used to simulate the hadronic/electromagnetic showers produced by the forward collision products from the interaction regions of the LHC. The capability of instrumentation to measure the luminosity of individual bunches in a 40MHz bunch train is demonstrated.

NTIS

Ionization Chambers; Luminosity; Neutral Particles; Quadrupoles; Collisions

20020070271 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Superconducting Magnetics for Induction Linac Phase-Rotation in a Neutrino Factory

Green, M. A.; Yu, S.; 2002; In English

Report No.(s): DE2002-795332; LBNL-48445; No Copyright; Avail: National Technical Information Service (NTIS)

The neutrino factory(1-3) consists of a target section where pions are produced and captured in a solenoidal magnetic field. Pions in a range of energies from 100 MeV to 400 MeV decay into muons in an 18-meter long channel of 1.25 T superconducting solenoids. The warm bore diameter of these solenoids is about 600 mm. The phase rotation section slows down the high-energy muon and speeds up the low energy muons to an average momentum of 200 MeV/c. The phase-rotation channel consists of three induction linac channels with a short cooling section and a magnetic flux reversal section between the first and second induction linacs and a drift space between the second and third induction linacs. The length of the phase rotation channel will be about 320 meters. The superconducting coils in the channel are 0.36 m long with a gap of 0.14 m between the coils. The magnetic induction within the channel will be 1.25. For 260 meters of the 320-meter long channel, the solenoids are inside the induction linac. This paper discusses the design parameters for the superconducting solenoids in the neutrino factory phase-rotation channel.

NTIS

Superconducting Magnets; Neutrinos; Magnetic Materials; Magnetic Flux; Linear Accelerators

20020070272 Lawrence Livermore National Lab., Livermore, CA USA

Manufacturing Experience for the LHC Inner Triplet Quadrupole Cables

Scanlan, R. M.; Highley, H. C.; Bossert, R.; Kerby, J.; Ghosh, A. K.; 2002; 10p; In English

Report No.(s): DE2002-795513; LBNL-49905; SC-MAG-769; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The design for the U.S. LHC Inner Triplet Quadrupole magnet requires a 37 strand (inner layer) and a 46 strand (outer layer) cable. This represents the largest number of strands attempted to date for a production quantity of Rutherford-type cable. The cable parameters were optimized during the production of a series of short prototype magnets produced at FNAL. These optimization studies focused on critical current degradation, dimensional control, coil winding, and interstrand resistance. After the R and D phase was complete, the technology was transferred to NEEW and a new cabling machine was installed to produce these cables. At present, about 60 unit lengths, out of 90 required for the entire production series of magnets, have been completed for each type of cable. The manufacturing experience with these challenging cables will be reported. Finally, the implications for even larger cables, with more strands, will be discussed.

NTIS

Superconducting Magnets; Manufacturing; Critical Current; Atomic Energy Levels

20020070273 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Superconducting Solenoids for Muon-Cooling in the Neutrino Factory

Green, M. A.; Miller, J. R.; Prestemon, S.; 2002; 16p; In English

Report No.(s): DE2002-795511; LBNL-48446; SCMAG-750; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The cooling channel for a neutrino factory consists of a series of alternating field solenoidal cells. The first section of the bunching cooling channel consists of 41 cells that are 2.75-m long. The second section of the cooling channel consists of 44 cells that are 1.65-m long. Each cell consists of a single large solenoid with an average diameter of 1.5 m and a pair of flux reversal solenoids that have an average diameter of 0.7 to 0.9 meters. The magnetic induction on axis reaches a peak value of about 5 T at the end of the second section of the cooling channel. The peak on axis field gradients in flux reversal section approaches 33 T/m. This report describes the two types of superconducting solenoid magnet sections for the muon-cooling channel of the proposed neutrino factory.

NTIS

Superconducting Magnets; Neutrinos; Muons; Magnetic Induction

20020070357 Department of Energy, Washington, DC USA

Electroproduction of Strangeness on Light Nuclei

Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-43169; No Copyright; Avail: National Technical Information Service (NTIS)

The $A(e, e'K^+ \Lambda^0)YX$ reaction has been investigated in Hall C at Jefferson Laboratory for 6 different targets. Data were taken for Q^2 (approx) 0.35 and 0.5 GeV² at a beam energy of 3.245 GeV for (^1H), (^2H), (^3He), (^4He), C and Al targets. The missing mass spectra are fitted with Monte Carlo simulations taking into account the production of (Λ) and (Σ^0) hyperon production off the proton, and (Σ^-) off the neutron. Models for quasifree

production are compared to the data, excess yields close to threshold are attributed to FSI. Evidence for (Λ)-hypernuclear bound states is seen for ($\text{sup } 3,4$)He targets.

NTIS

Strangeness; Hypernuclei; Mass Spectra; Monte Carlo Method

20020070358 Argonne National Lab., IL USA

Nucleon Momentum Distributions from a Modified Scaling Analysis of Inclusive Electron-Nucleus Scattering

Arrington, J.; Apr. 30, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-43167; No Copyright; Avail: National Technical Information Service (NTIS)

Inclusive electron scattering from nuclei at low momentum transfer (corresponding to $x < 1$) and moderate Q^2 is dominated by quasifree scattering from nucleons. In the impulse approximation, the cross section can be directly connected to the nucleon momentum distribution via the scaling function $F(y)$. The breakdown of the y -scaling assumptions in certain kinematic regions have prevented extraction of nucleon momentum distributions from such a scaling analysis. With a slight modification to the y -scaling assumptions, it is found that scaling functions can be extracted which are consistent with the expectations for the nucleon momentum distributions.

NTIS

Electron Scattering; Nucleons; Momentum Transfer; Kinematics

20020070359 Argonne National Lab., IL USA

Assessment of Lead-Bismuth Eutectic Target Material for Accelerator Driven Transmuters

Gohar, Y.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-43135; No Copyright; Avail: National Technical Information Service (NTIS)

Lead-Bismuth Eutectic is under consideration as a target material with high-energy protons for generating spallation neutrons to operate actinide and fission product transmuters. An assessment has been performed to study the performance of this target material as a function of the main variables and the design selections. The assessment includes the neutron yield, the spatial energy deposition, the neutron spectrum, the beam window performance, and the target buffer requirements. Heat transfer, hydraulics, beam window material and stresses, and target engineering issues have been considered. The assessment has also considered high-energy deuteron particles to study the impact on the target performance.

NTIS

Eutectics; Accelerators; Spallation; Bismuth

20020070360 Argonne National Lab., Advanced Photon Source Div., IL USA

Advanced Intraundulator Electron Beam Diagnostics Using COTR Techniques

Lumpkin, A. H.; Berg, W. J.; Biedron, S.; Borland, M.; Chae, Y. C.; 2002; In English

Report No.(s): DE2002-43119; No Copyright; Avail: National Technical Information Service (NTIS)

A significant advance in intraundulator electron-beam diagnostics has recently been demonstrated based on coherent optical transition radiation (COTR) imaging. We find signal strengths from a microbunched beam in a UV-visible free-electron laser to be several orders of magnitude higher than that of incoherent optical transition radiation. In addition we report that the far-field images of COTR interferograms carry information about beam size and asymmetry, divergence, and pointing.

NTIS

Electron Beams; Diagnosis; Free Electron Lasers; Coherent Light; Optical Transition

20020070523 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Reduction of Nonlinear Resonance Excitation from Insertion Devices in the ALS

Robin, D.; Krebs, G.; Portmann, G.; Zholents, A.; Decking, W.; Apr. 1995; 10p; In English

Report No.(s): DE2002-114568; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Theoretical studies of Lawrence Berkeley Laboratory's Advanced Light Source (ALS) storage ring predict strong field insertion devices will break the rings symmetry, increasing resonance excitation that may reduce the dynamic aperture and thus the beam lifetime. The authors have embarked on an experimental program to study the strength of nonlinear resonance excitation in the ALS when insertion devices are present. They observe an enhancement in the resonance excitation of a third-order resonance

when the gap of the insertion device is narrowed. They also find that it is possible to suppress this resonance by detuning two quadrupoles on either side of the insertion device. The results of this study are presented in this paper.

NTIS

Resonance; Light Sources; Augmentation; Nonlinearity

20020070573 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

RHIC D0 Insertion Dipole Design Iterations during Production

Schmalzle, J.; Anerella, M.; Ganetis, G.; Ghosh, A.; Gupta, R.; 2002; 8p; In English

Report No.(s): DE2002-794094; BNL-69122; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Iterations to the cross section of the Relativistic Heavy Ion Collider (RHIC) D0 Insertion Dipole magnets were made during the production. This was included as part of the production plan because no R&D or pre-production magnets were built prior to the start of production. The first magnet produced had the desired coil pre-stress and low field harmonics in the body of the magnet and is therefore being used in the RHIC Machine. On the first eight magnets, iterations were carried out to minimize the iron saturation and to compensate for the end harmonics. This paper will discuss the details of the iterations made, the obstacles encountered, and the results obtained. Also included will be a brief summary of the magnet design and performance.

NTIS

Superconducting Magnets; Stress Distribution; Harmonics; Iteration

20020070589 Argonne National Lab., IL USA

Towards Measuring the Charge Radius of (6)He and (8)He

Mueller, P.; Wang, L. B.; Bailey, K.; Drake, G. W. F.; Du, X.; 2002; 16p; In English

Report No.(s): DE2002-43103; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report on the progress towards measuring the charge radius of (sup 6)He and (sup 8)He nuclei by performing laser spectroscopy on these helium atoms in a magneto optical trap (MOT). First tests to produce neutral (sup 6)He atoms via the (sup 12)C((sup 7)Li, (sup 6)He)(sup 13)N reaction at the ATLAS accelerator have been successfully conducted. The MOT apparatus including the laser system and the discharge source to populate the metastable level are currently being set up.

NTIS

Nuclei; Helium; Helium Atoms; Metastable State

71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.

20020068011 Texas Univ., Applied Research Labs., Austin, TX USA

Broadband, Range-Dependent Normal Mode Model Development Final Report, 1 Jan. 1998-31 Dec. 2000

Westwood, Evan K.; Jul. 09, 2002; 18p; In English; Original contains color images

Contract(s)/Grant(s): N000014-98-I-0116

Report No.(s): AD-A404172; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Practical approaches to modeling broadband acoustic propagation in range-dependent environments using normal mode theory were developed. A method for eliminating the branch line integral from the normal mode solution was developed, analyzed, and documented in a JASA article. The accuracy and characteristics of various adiabatic- and coupled-mode approaches for range-dependent benchmark problems were investigated. A method for extracting the acoustic modes of propagation and inverting for the acoustic parameters of the ocean and ocean bottom using data measured on a vertical line array was investigated. The results of the investigation were documented in a Ph.D. dissertation and in a JASA article.

DTIC

Underwater Acoustics; Sound Transmission

20020068065 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

NRL-APL Grain Size Algorithm Upgrade

Briggs, Kevin B.; Jackson, Darrell R.; Moravan, K. Y.; Jun. 28, 2002; 38p; In English; Original contains color images

Contract(s)/Grant(s): Proj-74-7076-A1

Report No.(s): AD-A403759; NRL/MR/7430--02-8274; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This upgrade was designed to improve upon older algorithms used to infer input geoacoustic parameters from high-frequency acoustic models from sediment grain size. These older algorithms were based on limited data set and were developed by adjusting acoustic model-data fits rather than by statistical regression. The upgrade has two components. The regression analysis of sediment grain size and geoacoustic properties was performed by NRL and the determination of accuracy of acoustic backscatter predictions was performed by APL-UW. The geoacoustic properties/sediment grain size relationships produced a new algorithm connecting acoustic model parameters with the parameters of the MIW (Mine Warfare) sediment database.

DTIC

Acoustic Properties; Acoustics; Algorithms; Grain Size; Mathematical Models

20020068084 Woods Hole Oceanographic Inst., MA USA

Acoustic Communication for High-Doppler Guidance and Control *Final Report, Mar. 2000-Sep. 2001*

Freitag, Lee E.; Jul. 15, 2002; 40p; In English; Original contains color images

Contract(s)/Grant(s): N00014-00-1-0357

Report No.(s): AD-A404027; WHOI-13035700; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The long-term goal of this program is to provide an acoustic communications system suitable for multiple fast-moving platforms to support the guidance and control function of current and future weapons (Figure 1). The technological objective is the development and testing of single and multi-user acoustic communications solutions suitable for use on weapons systems. The advantage of an acoustic link is that it does not rely upon the wire which is currently used. The wire may break (either accidentally or on purpose) and it restricts the motion of the launching platform. The acoustic link allows multiple platforms to provide the weapon with information, and also allows weapons to communicate in order to coordinate salvo attacks.

DTIC

Weapon Systems; Communication; Underwater Acoustics

20020069086 Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden

Split-Beam Correlation Processing

Parastates, E.; Levonen, M.; Nilsson, B.; Soederberg, P.; Apr. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-105014; FOI-R-0139-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This work demonstrates the implementation of a split-beam correlation algorithm by simulations and experimental data analyses. The basic assumptions made are that noise processes sampled by different hydrophones are stationary Gaussian and mutually statistically independent. Furthermore the source signal is supposed to be generated from a sufficiently distant source so that its wave front may be regarded as planar over the array aperture, i.e. the plane wave approximation applies.

NTIS

Signal Processing; Algorithms; Statistical Correlation; Data Processing

20020069101 National Aerospace Lab., Amsterdam Netherlands

Comparison of Measured and Predicted Airfoil Self-Noise with Application to Wind Turbine Noise Reduction

Dassen, T.; Wagner, S.; Parchen, R.; Kang, S.; Guidati, G.; Nov. 11, 1997; 16p; In English

Report No.(s): PB2002-105881; NLR-TP-97564-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the ongoing JOULE-III project Development of Design Tools for Reduced Aerodynamic Noise Wind Turbines (DRAW), prediction codes for inflow-turbulence (IT) noise and turbulent boundary layer trailing-edge (TE) noise, are developed and validated. It is shown that the differences in IT noise radiation between airfoils having a different shape, are correctly predicted. The first, preliminary comparison made between predicted and measured TE noise spectra yields satisfactory results.

NTIS

Wind Turbines; Aerodynamic Noise; Noise Reduction; Noise Prediction; Sound Waves

ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.

20020067722 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

Stress Synergy in Proton Induced Single Event Effects in SRAM

Erhardt, L. S.; Cousins, T.; Estan, D.; Nov. 2001; 42p; In English; Original contains color images

Report No.(s): AD-A403863; DREO-TR-2001-122; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study was conducted to determine the effect of prior exposure to radiation on the proton-induced single event effect (SEE) cross section for SRAM devices. This was done in order to determine whether or not proton testing of virgin parts accurately determines the likely rate of single event effects for these parts in a space environment. Two types of SRAM parts were exposed to various doses of gamma radiation and then tested with identical proton irradiations to determine their SEE cross sections. The results of these experiments were analyzed to determine the expected number of SEE events for these devices in typical space radiation environments, including the radiation environment of RADARSAT II. Both types of SRAM chips showed an increase in the SEE rate with prior radiation exposure. One type of SRAM, the D431000ACZ-70L, showed such a dramatic increase in the SEE rate that early failure in a satellite mission due to natural radiation, or in the event of an exo-atmospheric nuclear detonation, is likely.

DTIC

Radiation Effects; Extraterrestrial Radiation; Aerospace Environments; Proton Irradiation

20020067773 Virginia Univ., Dept. of Physics, Charlottesville, VA USA

A Study of NaBi(WO₄)₂ as a Cherenkov Radiator

Williams, David G.; Aug. 2002; 66p; In English

Report No.(s): AD-A403809; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this thesis is to examine the properties of NaBi(WO₄)₂ and determine its usefulness as a Cherenkov radiator. An implicit requirement in this process is to determine the best configuration of a counter using NaBi(WO₄)₂ to detect the Cherenkov photons using a photomultiplier tube.

DTIC

Charged Particles; Particle Beams; Tungstates; Radiation Counters

20020068028 Notre Dame Univ., IN USA

Ion/Surface Interactions and Reaction Mechanisms Final Report, 1 Jan.-31 Dec. 2001

Jacobs, Dennis C.; Dec. 2001; 16p; In English

Contract(s)/Grant(s): F49620-01-1-0134

Report No.(s): AD-A403892; AFRL-SR-AR-TR-02-0208; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The PI (Principal Investigator) has demonstrated for the first time that hyperthermal energy atomic oxygen ions can directly abstract oxygen atoms from and deposit oxygen atoms into a silicon oxide surface. Isotopic labeling and 2-D (two-dimensional) velocity-resolved detection have allowed for the unambiguous assignment of two distinct abstraction mechanisms. In the first, an incident oxygen ion scatters from the lattice and abstracts an oxygen atom on the ion's departure from the surface. In the second mechanism, the energetic atomic oxygen ion generates an oxygen recoil, that in turn abstracts a neighboring oxygen atom from the silicon oxide lattice. In concert with the etching of oxygen from the surface, many of the incident oxygen ions become incorporated into the silicon oxide lattice. Isotopic labeling experiments have measured the cross section by which hyperthermal oxygen projectiles are incorporated into the topmost layer of the silicon oxide film. The largest rates of incorporation occur for 5 eV oxygen ions. These state-of-the-art experiments have demonstrated that the bombardment of silicon oxide with hyperthermal oxygen ions, such as in a LEO (low Earth orbit) environment, can lead to changes in the gas/solid interface.

DTIC

Oxide Films; Silicon Compounds; Silicon Oxides; Oxygen Atoms; Oxygen Ions

20020068994 California Univ., Davis, CA USA

Systematics of Heavy Quark Production at RHIC

Vogt, R.; 2002; 14p; In English

Report No.(s): DE2002-792979; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We discuss a program for systematic studies of heavy quark production in pp, pA and AA interactions. The $Q(\text{ovr } Q)$ production cross sections themselves cannot be accurately predicted to better than 50% at RHIC. For studies of deviations in $Q(\text{ovr } Q)$ production such as those by nuclear shadowing and heavy quark energy loss, the pp cross-section thus needs to be measured. We then show that the ratio of pA to pp dilepton mass distributions can provide a measurement of the nuclear gluon distribution. With total rates and nuclear shadowing under control it is easier to study energy loss and to use $c(\text{ovr } c)$ as a normalization of $J(\Psi)$ production.

NTIS

Particle Production; Quarks; Energy Dissipation

20020069125 NASA Ames Research Center, Moffett Field, CA USA

Ultraviolet Irradiation of Polycyclic Aromatic Hydrocarbons (PAHs) in Ices: Production of Alcohols, Quinones, and Ethers

Bernstein, Max P., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; Gillette, J. Seb, Stanford Univ., USA; Clemett, Simon J., Stanford Univ., USA; Zare, Richard N., Stanford Univ., USA; Oct. 23, 1998; 15p; In English

Contract(s)/Grant(s): NAG5-4936; NAG5-7208; RTOP 344-37-44-01; RTOP 344-38-12-04; Copyright; Avail: Issuing Activity

Ice samples containing one part of polycyclic aromatic hydrocarbons (PAHs) in 500 or more parts of water are exposed to ultraviolet radiation and the resulting photochemical products are analyzed using infrared spectroscopy and mass spectrometry. Peripheral carbon atoms are oxidized to yield alcohols, ketones, and ethers. Deuterium labeling experiments demonstrate that hydrogen exchange with water is facile under irradiation, which may explain the deuterium enrichments found in PAHs in various meteoritic materials. In some cases peripheral carbon atoms are reduced and these may account for the 3.4 microns interstellar emission feature. The rich photochemistry of PAHs trapped in ice matrices has important implications for the role of extraterrestrial organics in biogenesis and may also be of significant environmental consequence.

Author

Ultraviolet Radiation; Polycyclic Aromatic Hydrocarbons; Ice; Alcohols; Production; Ethers

20020070207 Fermi National Accelerator Lab., Batavia, IL USA

Visions: The Coming Revolutions in Particle Physics

Quigg, C.; 2002; 20p; In English

Report No.(s): DE2002-793426; FERMILAB-CONF-02/058-T; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Wonderful opportunities await particle physics over the next decade, with the coming of the Large Hadron Collider to explore the 1-TeV scale (extending efforts at LEP and the Tevatron to unravel the nature of electroweak symmetry breaking) and many initiatives to develop the understanding of the problem of identity and the dimensionality of spacetime.

NTIS

Hadrons; Space-Time Functions; Particle Accelerators; Electroweak Interactions (Field Theory)

20020070211 Rockefeller Univ., New York, NY USA

CDF Run 1 Diffractive Results

Hatakeyama, K.; May 2002; 14p; In English

Report No.(s): DE2002-794469; FERMILAB-CONF-02/086-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Results on soft and hard diffraction obtained by the CDF Collaboration in Run 1 of the Fermilab Tevatron p (with a line over the top) p collider are presented. Comparisons are made with theoretical predictions and with results from the DESY ep collider HERA.

NTIS

Diffraction; Particle Accelerators

20020070373 Rockefeller Univ., New York, NY USA

Jet Production at CDF

Mesropian, C.; Apr. 2002; In English

Report No.(s): DE2002-793541; FERMILAB-CONF-02/065-E; No Copyright; Avail: National Technical Information Service (NTIS)

In this talk I present the results from the measurement of the inclusive jet cross section and strong coupling constant based on the CDF Run 1B data, and discuss prospects for Run 2.

NTIS

Coupling; Cross Sections

73 NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

20020068024 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Efficient and Accurate Computation of Non-Negative Anisotropic Group Scattering Cross Sections for Discrete Ordinates and Monte Carlo Radiation Transport

Gerts, David W.; Jul. 2002; 106p; In English

Report No.(s): AD-A404073; AFIT/DS/ENP/02-04; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A new method for approximating anisotropic, multi-group scatter cross sections for use in discretized and Monte Carlo multi-group neutron transport is presented. The new method eliminates unphysical artifacts such as negative group scatter cross sections and falsely positive cross sections. Additionally, when combined with the discrete elements angular quadrature method, the new cross sections eliminate the lack of angular support in the discrete ordinates quadrature method. The new method generates piecewise-average group-to-group scatter cross sections. The accuracy and efficiency for calculating the discrete elements cross sections has improved by many orders of magnitude compared to DelGrande and Mathews previous implementation. The new cross sections have extended the discrete elements method to all neutron-producing representations in the Evaluated Nuclear Data Files. The new cross section method has been validated and tested with the cross section generation code, NJOY. Results of transport calculations using discrete elements, discrete ordinates, and Monte Carlo methods for two, one-dimensional slab geometry problems are compared.

DTIC

Anisotropy; Scattering Cross Sections

20020068062 NASA Marshall Space Flight Center, Huntsville, AL USA

The Beamed Energy Technology Working Group, Programs and Goals

Montgomery, Edward E., IV, National Space Science and Technology Center, USA; [2002]; 1p; In English; 33rd AIAA Plasmadynamics and Lasers Conference, 19-23 May 2002, Maui, HI, Maui, HI, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A brief description of the Beamed Energy Technology Program will be given. Its relationship to the overall Advanced Technology Program at Marshall Space Flight Center will be discussed. A summary description of the known potential benefits and technical issues remaining in the development of a viable system will be presented along with program plans for a NASA Research Announcement in FY03 to begin development of relevant technologies and systems concepts. The results of workshop activity by the Beamed Energy Technology Working Group will be provided.

Author

Energy Technology; Power Beaming; NASA Programs

20020068967 Edgerton, Germeshausen and Grier, Inc., Wallops Flight Facility, Wallops Island, VA USA

[Progress of the ATM crew], Apr. - May 2002

[2002]; 18p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-99094; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Activities for the Airborne Oceanographic Lidar (AOL) and the SeaWiFs data analysis projects supported under NASA contract NAS5-99094 for the period of April 2002 to May 2002 are recorded. Topics covered include: data acquisition, data analysis, field activities and software development.

CASI

Airborne Lasers; Remote Sensing; Data Acquisition; Ocean Data Acquisitions Systems; Satellite Imagery

20020068987 Department of Energy, Washington, DC USA

Radiological Considerations for the Operation of the Advanced Photon Source Storage Ring - Revised

Moe, H. J.; Sep. 24, 1997; 66p

Report No.(s): DE2002-42842; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report deals with the radiological considerations of operations using 7700-MeV positron and electron beams in the storage ring (SR) tunnel. The radiological considerations addressed include the following: prompt secondary radiation (bremsstrahlung, giant resonance neutrons, medium and high energy neutrons, and muons) produced by electrons/positrons interacting in a beam stop or by particle losses in the component structures; skyshine radiation, which produces a radiation field in nearby areas and at the nearest off-site location; radioactive gases produced by neutron irradiation of air in the vicinity of a particle loss site; noxious gases (ozone and others) produced in air by the escaping bremsstrahlung radiation that results from absorbing particles in the components or by synchrotron radiation escaping into the tunnel; activation of the storage ring components that results in a residual radiation field in the vicinity of these materials following shutdown; potential activation of water used for cooling the magnets and other purposes in the SR tunnel; evaluation of the radiation fields due to escaping synchrotron radiation and gas bremsstrahlung. Estimated dose rates outside of the tunnel, in the early assembly area (EAA), and in the Experiment Hall for several modes of operation (including potential safety envelope beam power, normal beam power, and MCI (maximum credible incident) conditions) have been computed. Shielding in the first optics enclosure (FOE) and for the photon beamlines is discussed in ANL/APS/TB-7 (IPE 93), but additional radiological considerations for the ASD diagnostic beamlines are contained in Appendix C. Although the calculations refer to positrons, electron operation would produce essentially the same effects for the identical assumptions.

NTIS

Bremsstrahlung; Neutron Irradiation; Muons; Radiation Distribution; Ozone

20020068991 Argonne National Lab., IL USA

Quantitative Determination of (252)Cf

Ahmad, I.; Moore, E. F.; Porter, C. E.; Greene, J. P.; Felker, L. K.; 2002; 10p; In English

Report No.(s): DE2002-43033; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Sealed (sup 252)Cf sources in the microCurie to milliCurie range are routinely used in industry and research. At present, no reliable analytical method is available for precise determination of the activity. Very strong sources can be analyzed by neutron counting but the error is large. The authors propose to use gamma-ray spectroscopy for such analysis. In particular, high-energy gamma rays (above 1 MeV) of fission fragments in equilibrium with the source are very convenient because they have little absorption in materials surrounding the source. They have measured the gamma/alpha ratio for (sup 252)Cf with an uncertainty of better than 5%. The experiment involved the preparation of several thin (sup 252)Cf sources, alpha pulse height analysis, determination of alpha decay rate, and the measurement of gamma singles spectrum with a well shielded germanium spectrometer. The measured ratio and the gamma ray spectroscopy of unknown samples can provide the activity of (sup 252)Cf in these samples.

NTIS

Gamma Ray Spectrometers; Decay Rates; Californium Isotopes

20020068993 Argonne National Lab., IL USA

Thermal Response of the Multiplier of an Accelerator Driven System to Beam Interruptions

Dunn, F. E.; 2002; 14p; In English

Report No.(s): DE2002-43024; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thermal response of the multiplier of an accelerator driven system to beam trips has been calculated for sodium cooled and lead-bismuth cooled multipliers. The temperature transients caused by a beam trip lead to thermal fatigue in structural components, and restoring the beam causes an additional temperature transient that adds to thermal fatigue. Design lifetimes for various multiplier components are calculated, based on the frequency of beam interruptions and on the thermal fatigue per interruption. Mitigation strategies to increase design lifetimes are discussed.

NTIS

Accelerators; Frequency Multipliers; Frequencies; Multipliers; Temperature Effects

20020069089 Argonne National Lab., IL USA

New Approach to High-Current Operation of the Advanced Photon Source

Shenoy, G. K.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-42787; ANL/APS/TB-43; No Copyright; Avail: National Technical Information Service (NTIS)

It is shown that the operation of the Advanced Photon Source (APS) storage ring at 6 GeV will (1) deliver higher brilliance at x-ray energies used by a majority of users due to natural reduction in electron beam emittance at lower storage ring energy, and (2) lower the total power produced by insertion devices thus permitting stored currents up to 300 mA with minimal changes in accelerator or beamline hardware. While higher brilliance x-ray beams can be realized from the APS undulators by only increasing the stored current for the present modes of operation, this however leads to serious high heat load concerns. This report includes detailed analyses of radiation brilliance, undulator tunability, power, power density, and total and coherent flux as a function of x-ray energy from various harmonics of undulator-A, for operation at 6.0, 6.5 and 7.0 GeV with 100, 140, 200 and 300 mA currents. A discussion of a smaller period (2.7 cm) undulators spectral performance is also presented. It is shown that the APS can be immediately operated at 6 GeV with 200-300 mA current to benefit user science in the x-ray energy range below 35 keV. This may not require any hardware change either in the storage ring or the beamlines, making this switch without any interruptions to user research programs. Finally, the suggested 6 GeV operation with 300 mA should be considered a temporary step towards higher brilliance operation. A need for re-optimization of the APS technical operations, defined by storage-ring energy, current, undulator period, and power, are also addressed in this report.

NTIS

Emittance; High Current; Ring Currents

20020069090 Argonne National Lab., Advanced Photon Source Div., IL USA

Neutron Fluence Estimates Inside the APS Storage Ring During Normal Operation

Job, P. K.; Alderman, J.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available in CD-ROM

Report No.(s): DE2002-42785; LS-294; No Copyright; Avail: National Technical Information Service (NTIS)

In an electron storage ring, neutrons are generated as a result of the electron beam interaction with high-Z materials, such as scrapers and collimators. When the energy of the incident electron beam is sufficiently high, it can produce high-energy photons, which subsequently interact with a nucleus, resulting in the emission of nucleons. This interaction is known as a photoneuclear interaction. For photons with energies above the typical binding energy of nucleons (less than 5-15 MeV), photoneuclear interaction generally leads to emission of photoneutrons as well as photoprotons. Photoneuclear interaction is mainly the result of three specific processes: giant nuclear dipole resonance, quasi-deuteron production and decay, and intranuclear cascade generated via photopion production.

NTIS

Neutrons; Beam Interactions; Binding Energy

20020069091 Los Alamos National Lab., NM USA

Electron Proton Two-Stream Instability at the PSR

Macek, R. J.; Browman, A.; Fitzgerald, D.; McCrady, R.; Merrill, F.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-42049; No Copyright; Avail: National Technical Information Service (NTIS)

A strong, fast, transverse instability has long been observed at the Los Alamos Proton Storage Ring (PSR) where it is a limiting factor on peak intensity. Most of the available evidence, based on measurements of the unstable proton beam motion, is consistent with an electron-proton two-stream instability. The need for higher beam intensity at PSR and for future high intensity, proton drivers has motivated a multi-lab collaboration (LANL, ANL, FNAL, LBNL, BNL, ORNL, and PPPL) to coordinate research on the causes, dynamics and cures for this instability. Important characteristics of the electron cloud were recently measured with retarding field electron analyzers and various collection electrodes. Suppression of the electron cloud formation by TiN coatings has confirmed the importance of secondary emission processes in its generation. New tests of potential controls included dual harmonic rf, damping by higher order multipoles, damping by X,Y coupling and the use of inductive inserts to compensate longitudinal space charge forces. With these controls and higher rf voltage the PSR has accumulated stable beam intensity up to 9.7 microC/pulse (6×10 to the 13th power protons), which is a 60% increase over the previous maximum.

NTIS

Electrons; Accelerators; Electric Potential; Electron Clouds; Radio Frequencies

20020070363 Fermi National Accelerator Lab., Batavia, IL USA

CDF at the Tevatron Collider in Run 2

Erbacher, R. D.; Mar. 2002; In English

Report No.(s): DE2002-793219; FERMILAB-CONF-02/021-E; No Copyright; Avail: National Technical Information Service (NTIS)

Run 2 of the Tevatron began in early 2001 after extensive upgrades to both the machine and the CDF and D0 detectors. For CDF, new tracking detectors, increased muon coverage, state-of-the-art front end electronics, pipelined triggering, and a complete overhaul of the DAQ have made it a very powerful tool to explore physics of all kinds. The status of CDF in Run 2 is presented, along with a first glimpse of CDF data.

NTIS

Particle Accelerators; Pipelines

20020070364 Texas Technological Univ., Dept. of Physics, Lubbock, TX USA

Tevatron B-Physics: Recent Results and Prospects

Papadimitriou, V.; Apr. 2002; In English

Report No.(s): DE2002-793816; FERMILAB-CONF-02/070-E; No Copyright; Avail: National Technical Information Service (NTIS)

Between 1992 and 1996, the CDF and D0 experiments have collected data samples of 110 pb(sup -1) each of p(bar p) collisions at (radical)s = 1.8 TeV at the Fermilab Tevatron. In the year 2001 the Tevatron commenced p(bar p) collisions again at (radical)s = 1.96 TeV with the goal of delivering an integrated luminosity of 1 fb(sup -1) per year. In the mean time the CDF and D0 detectors have undergone substantial upgrades which allow for a rich B physics program with unique capabilities. In this paper we discuss recent results and the B Physics prospects at the Tevatron with 2 fb(sup -1) of data (Run IIa) or 15 fb(sup -1) of data (Run IIa+Run IIb).

NTIS

Particle Accelerators; Data Processing; Collisions

20020070574 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

Change in Field Harmonics After Quench and Thermal Cycles in Superconducting Magnets

Gupta, R.; Jain, A.; Muratore, J.; Wanderer, P.; Willen, E.; 1998; 8p; In English

Report No.(s): DE2002-794092; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A change in field harmonics after quench and thermal cycles has been observed in superconducting magnets for the Relativistic Heavy Ion Collider (RHIC). This paper presents the results of a systematic investigation of this effect in a number of RHIC dipole and quadrupole magnets. These changes in field harmonics may limit the ultimate field quality and its reproducibility in superconducting magnets. A change in pre-stress has also been observed after quench and thermal cycles. A possible link between these two changes is explored.

NTIS

Superconducting Magnets; Quadrupoles; Cycles

20020070582 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

Test of a Model Superconducting Magnet for the HERA ep Interaction Regions

Parker, B. P.; Anerella, M.; Escallier, J.; Ghosh, A.; Jain, A.; 2002; 8p; In English

Report No.(s): DE2002-794095; BNL-69137; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For the HERA luminosity upgrade two types of compact multifunction superconducting magnets, denoted GO and GG, are needed for installation inside the existing ZEUS and H1 experimental detectors in the year 2000. These magnets contain multiple concentric coil layers organized into independently powered quadrupole, dipole, skew quadrupole and skew dipole coil windings. Production of the first of three GO magnets using a newly constructed coil winding machine is currently in progress at BNL. The GG design is being completed and parallel production at BNL of three GG units will start soon. In this paper we highlight HERA upgrade magnet design challenges, present our production solutions and relate experience and results gained from warm and cold testing of short model magnets.

NTIS

Superconducting Magnets; Quadrupoles

20020070590 Argonne National Lab., IL USA

Nonintercepting Imaging Diagnostics for the APS Injector during Storage Ring Top-Up Operations

Lumpkin, A. H.; Berg, W. J.; Yang, B. X.; 2002; 10p; In English

Report No.(s): DE2002-43099; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The recently implemented top-up operating mode of the Advanced Photon Source (APS) storage ring has motivated an emphasis on nonintercepting imaging diagnostics in the injectors. We present the upgrades to the optical synchrotron radiation (OSR) monitors on the accumulator ring and injector synchrotron as well as the plans for a new OSR monitor on a chicane dipole

in the linac and for an optical diffraction radiation (ODR) monitor for the 7-GeV transport line to the storage ring. Two key issues are signal strength for a single macropulse in the chicane and discriminating key transverse information from the visible light ODR, respectively.

NTIS

Storage Rings (Particle Accelerators); Diagnosis; Optical Properties; Imaging Techniques; Diffraction Radiation

74 OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20020067733 NASA Marshall Space Flight Center, Huntsville, AL USA

Enhancement of Optical Nonlinearities Via Whispering Gallery Mode Splitting

Chang, Hongrok, NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Fuller, Kirk A., Alabama Univ., USA; [2002]; 1p; In English; 47th; International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An iterative method is applied to the analysis of N coupled ring-resonators, and the results are compared with multilayered spheres. Splitting of the whispering gallery modes into N higher-Q modes occurs when the round-trip phase shifts in each ring (or layer) are equal, in agreement with results for planar resonators. This mode-splitting is, therefore, a universal phenomenon for resonant structures, and can lead to reduced thresholds for nonlinear optical effects.

Author

Nonlinear Optics; Whispering Gallery Modes; Iteration; Splitting

20020067754 Rochester Univ., Inst. of Optics, NY USA

New Materials and Structures for Nonlinear Optics Final Report, 1 Dec. 1998-30 Nov. 2001

Boyd, Robert W.; Nov. 2001; 8p; In English

Contract(s)/Grant(s): F49620-99-1-0061; AF Proj. 2301

Report No.(s): AD-A403743; AFRL-SR-AR-TR-02-0213; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this research project is to develop novel optical materials and related structures with superior properties for use in nonlinear optics. This work is motivated by the need for high quality materials with large nonlinear coefficients for use in nonlinear and photonics devices and by the realization that new structures developed in recent years provide the possibility for new types of nonlinear optical devices and interactions. Devices that could benefit from these new and improved materials include eye/sensor protection devices, optical switches, and phase conjugating aberration correction devices.

DTIC

Nonlinear Optics; Optical Materials; Photonics; Optical Equipment

20020067763 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA

High-Bandwidth Adaptive-Optic System Final Report, 1 Apr. 2001-31 Mar. 2002

Jumper, Eric J.; Jun. 05, 2002; 5p; In English

Contract(s)/Grant(s): F49620-01-1-0323; Proj-MIPR

Report No.(s): AD-A403742; AFRL-SR-AR-TR-02-0215; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This award was to procure a high-bandwidth adaptive-optic system. A system capable of operating at 20 kHz was contracted to be constructed by Boeing SVS, Albuquerque NM using hardware primarily furnished by Xinetics. The components and operational concept for the adaptive-optic system is described in this report.

DTIC

Adaptive Optics; Bandwidth; Optical Equipment

20020067794 Defence Science and Technology Organisation, Victoria, Australia

The Performance of Small Support Spatial and Temporal Filters for Dim Point Target Detection in IR Image Sequences

Warren, R. C.; Feb. 2002; 39p; In English

Report No.(s): AD-A404004; DSTO-TR-1282; DODA-AR-012-165; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effectiveness of small support spatial filters based on mean, median and morphological opening for the detection of scintillating ultra-dim stationary point targets in IR image sequences has been investigated. The effectiveness of two temporal filters was also studied. The filters were applied to two IR image sequences; an aircraft approaching in an uncluttered background, and an aircraft receding in a bright cloudy background. The spatial filters were effective in detecting the target in the benign background, but neither the spatial nor one of the temporal filters were effective in the cluttered environment. A combination of absolute frame differencing and small support spatial filtering to correct for sensor motion was found to give sufficient increase in signal to clutter ratio to allow detection.

DTIC

Image Processing; Spatial Filtering; Infrared Imagery; Clutter

20020068002 NASA Marshall Space Flight Center, Huntsville, AL USA

New Cryogenic Optical Test Capability at Marshall Space Flight Center's Space Optics Manufacturing Technology Center

Kegley, Jeff, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A new cryogenic optical testing capability exists at Marshall Space Flight Center's Space Optics Manufacturing Technology Center (SOMTC). SOMTC has been performing optical wavefront testing at cryogenic temperatures since 1999 in the X-ray Cryogenic Test Facility's (XRCF's) large vacuum chamber. Recently the cryogenic optical testing capability has been extended to a smaller vacuum chamber. This smaller horizontal cylindrical vacuum chamber has been outfitted with a helium-cooled liner that can be connected to the facility's helium refrigeration system bringing the existing kilowatt of refrigeration capacity to bear on a 1 meter diameter x 2 meter long test envelope. Cryogenic environments to less than 20 Kelvin are now possible in only a few hours. SOMTC's existing instruments (the Instantaneous Phase-shifting Interferometer (IPI) from ADE Phase-Shift Technologies and the PhaseCam from 4D Vision Technologies) view the optic under test through a 150 mm clear aperture BK-7 window. Since activation and chamber characterization tests in September 2001, the new chamber has been used to perform a cryogenic (less than 30 Kelvin) optical test of a 22.5 cm diameter x 127 cm radius of curvature SiO₂ mirror, a cryogenic survival (less than 30 Kelvin) test of an adhesive, and a cryogenic cycle (less than 20 Kelvin) test of a ULE mirror. A vibration survey has also been performed on the test chamber. Chamber specifications and performance data, vibration environment data, and limited test results will be presented.

Author

Cryogenic Temperature; Cryogenics; Optical Materials; Manufacturing; Vacuum Chambers

20020068088 Massachusetts Inst. of Tech., Cambridge, MA USA

Novel Materials for Optical Memory/Correlation Systems Final Report, Apr. 1999-Oct. 2000

Shahriar, Selim; Ezekiel, SHAoul; Oct. 2000; 20p; In English

Contract(s)/Grant(s): F19628-99-C-0016; AF Proj. 2305

Report No.(s): AD-A404054; AFRL-SN-HS-TR-2002-027; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project was to explore the characteristics of novel materials for optical data storage systems and correlators. To this end, we have made substantial progress.

DTIC

Quantum Theory; Optical Correlators; Data Storage; Coupling; Optical Equipment

20020068104 Eastman Kodak Co., Rochester, NY USA

Kodak AMSD Mirror Development Program

Matthews, Gary, Eastman Kodak Co., USA; Dahl, Roger, Eastman Kodak Co., USA; Barrett, David, Eastman Kodak Co., USA; Bottom, John, Eastman Kodak Co., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, USA

Contract(s)/Grant(s): NAS8-00148; No Copyright; Avail: Issuing Activity; Abstract Only

The Advanced Mirror System Demonstration Program is developing minor technology for the next generation optical systems. Many of these systems will require extremely lightweight and stable optics due to the overall size of the primary mirror. These segmented, deployable systems require new technology that AMSD is developing. The on-going AMSD program is a critical enabler for Next Generation Space Telescope (NGST) which will start in 2002. The status of Kodak's AMSD mirror and future plans will be discussed with respect to the NGST program.

Author

Optical Materials; NASA Space Programs; Mirrors; Research and Development

20020068449 Schafer Corp., Calabasas, CA USA

Silicon Lightweight Mirrors (SLMS) for Ultraviolet and Extreme Ultraviolet Imaging Mirrors

Goodman, W. A., Schafer Corp., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-01174; No Copyright; Avail: Issuing Activity; Abstract Only

Subtopic 01-S1.06 requires mirrors with a diameter of 0.5-2.4 meters, areal density less than 20 kg/sq m, a figure specification of 0.02-0.005 waves root mean square (rms) at 633 nanometers, a surface roughness 0.5-1 nanometers rms, and a midfrequency error of 1.0-2.5 nanometers rms for use in the infrared (IR) to extreme ultra violet (EUV) waveband. Schafer's Phase II objective is to use Silicon Lightweight Mirrors (SLMS), a novel, all-silicon, foam-core, lightweight mirror technology, to build three imaging mirrors for the Next Generation Space Telescope Near Infrared Camera (NIRCam) Engineering Test Unit: M0 (a flat), M2 (a concave sphere) and M3R (an oblate spheroid). The surface figure error specification for the NIRCam imaging mirrors is 8 nanometers rms (0.013 waves rms at 633 nanometers), equivalent to that required for ultraviolet (UV) and EUV mirrors, and this figure must be maintained at the 35 K operational temperature of NGST. The surface roughness required is 30 Å rms since NIRCam operates in the visible to infrared (VIS/IR) (0.65-5 microns). We will produce mounts for mirrors M2 and M3R using the complementary thermally matched C/SiC material demonstrated by Schafer under another NASA SBIR, NAS8-98137.

Author

Mirrors; Porous Silicon; Next Generation Space Telescope Project; Ultraviolet Astronomy; Infrared Astronomy

20020068711 NASA Marshall Space Flight Center, Huntsville, AL USA

Complex Refractive Index of Ammonium Nitrate in the 2-20 micron Spectral Range

Jarzemski, Maurice A., NASA Marshall Space Flight Center, USA; Norman, Mark L., SensIR Technologies, USA; Fuller, Kirk A., Alabama Univ., USA; Srivastava, Vandana, Universities Space Research Association, USA; Cutten, Dean R., Alabama Univ., USA; [2002]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Using high resolution Fourier Transform Infrared Spectroscopy (FTIR) absorbance/transmittance spectral data for ammonium sulfate (AMS), calcium carbonate (CAC) and ammonium nitrate (AMN), comparisons were made with previously published complex refractive indices data for AMS and CAC to infer experimental parameters to determine the imaginary refractive index for AMN in the infrared wavelength range from 2 to 20 microns. Kramers-Kronig mathematical relations were applied to calculate the real refractive index for the three compositions. Excellent agreement for AMS and CAC with the published values was found, validating the complex refractive indices obtained for AMN. Backscatter calculations using a lognormal size distribution for AMS, AMN, and CAC aerosols were performed to show differences in their backscattered spectra.

Author

Fourier Transformation; Infrared Spectroscopy; Kramers-Kronig Formula; Refractivity; Absorption Spectroscopy; Infrared Absorption

20020068822 Maine Univ., Dept. of Physics and Astronomy, ME USA

The Kinetics of Crystallization of Colloids and Proteins: A Light Scattering Study

McClymer, Jim, Maine Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXII-1 - XXXII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Hard-sphere colloidal systems serve as model systems for aggregation, nucleation, crystallization and gelation as well as interesting systems in their own right. There is strong current interest in using colloidal systems to form photonic crystals. A major scientific thrust of NASA's microgravity research is the crystallization of proteins for structural determination. The crystallization of proteins is a complicated process that requires a great deal of trial and error experimentation. In spite of a great deal of work, "better" protein crystals cannot always be grown in microgravity and conditions for crystallization are not well understood. Crystallization of colloidal systems interacting as hard spheres and with an attractive potential induced by entropic forces have been studied in a series of static light scattering experiments. Additionally, aggregation of a protein as a function of pH has been studied using dynamic light scattering. For our experiments we used PMMA (polymethylacrylate) spherical particles interacting as hard spheres, with no attractive potential. These particles have a radius of 304 nanometers, a density of 1.22 gm/ml and an index of refraction of 1.52. A PMMA colloidal sample at a volume fraction of approximately 54% was index matched in a solution of cycloheptyl bromide (CHB) and cis-decalin. The sample is in a glass cylindrical vial that is placed in an ALV static and dynamic light scattering goniometer system. The vial is immersed in a toluene bath for index matching to minimize flar. Vigorous shaking melts any colloidal crystals initially present. The sample is illuminated with diverging laser light (632.8 nanometers) from a 4x microscope objective placed so that the beam is approximately 1 cm in diameter at the sample location. The sample is rotated about its long axis at approximately 3.5 revolutions per minute (highest speed) as the colloidal crystal system is non-ergodic. The scattered light is detected at various angles using the ALV light detection optics, which is fed into an APD detector module and

linked to a computer. The scattering angle (between 12 and 160 degrees), scattering angle step size (0.1 degree minimum) and acquisition time (minimum 3 s) is set by the user.

Derived from text

Crystal Growth; Colloids; Crystals; Kinetics; Proteins; Light Scattering

20020068836 Austin Peay State Univ., Dept. of Physics, Clarksville, TN USA

Genetic Optimization of a Tensegrity Structure

Taylor, Jaime R., Austin Peay State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. L-1 - L-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Marshall Space Flight Center (MSFC) is charged with developing advanced technologies for space telescopes. The next generation of space optics will be very large and lightweight. Tensegrity structures are built of compressive members (bars), and tensile members (strings). For most materials, the tensile strength of a longitudinal member is larger than its buckling strength; therefore a large stiffness to mass ratio can be achieved by increasing the use of tensile members. Tensegrities are the epitome of lightweight structures, since they take advantage of the larger tensile strength of materials. The compressive members of tensegrity structures are disjoint allowing compact storage of the structure. The structure has the potential to eliminate the requirement for assembly by man in space; it can be deployed by adjustments in its cable tension. A tensegrity structure can be more reliably modeled since none of the individual members experience bending moments. (Members that experience deformation in more than one dimension are much harder to model.) A. Keane and S. Brown designed a satellite boom truss system with an enhanced vibration performance. They started with a standard truss system, then used a genetic algorithm to alter the design, while optimizing the vibration performance. An improvement of over 20,000% in frequency-averaged energy levels was obtained using this approach. In this report an introduction to tensegrity structures is given, along with a description of how to generate the nodal coordinates and connectivity of a multiple stage cylindrical tensegrity structure. A description of how finite elements can be used to develop a stiffness and mass matrix so that the modes of vibration can be determined from the eigenvalue problem is shown. A brief description of a micro genetic algorithm is then presented.

Author

Design Optimization; Genetic Algorithms; Tensegrity Structures; Trusses; Vibration; Finite Element Method; Stiffness Matrix

20020068964 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Performance of the VUV High Resolution and High Flux Beamline for Chemical Dynamics Studies at the Advanced Light Source

Heimann, P. A.; Koike, M.; Hsu, C. W.; Evans, M.; Ng, C. Y.; Jul. 1996; 20p; In English

Report No.(s): DE2002-406063; LBNL-39138; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

At the Advanced Light Source an undulator beamline, with an energy range from 6 to 30 eV, has been constructed for chemical dynamics experiments. The higher harmonics of the undulator are suppressed by a novel, windowless gas filter. In one branchline high flux, 2 % bandwidth radiation is directed toward an end station for photodissociation and crossed molecular beam experiments. A photon flux of photon/sec has been measured at this end station. In a second branchline a 6.65 m off- plane Eagle monochromator delivers narrow bandwidth radiation to an end station for photoionization studies. At this second end station a peak flux of 3×10^{11} was observed for 25,000 resolving power. This monochromator has achieved a resolving power of 70,000 using a 4800 grooves/mm grating, one of the highest resolving powers obtained by a VUV monochromator.

NTIS

Optical Measuring Instruments; Reaction Kinetics; Photoionization; Light Sources

20020068976 NASA Goddard Space Flight Center, Greenbelt, MD USA

ExSPO: A Discovery Class Apodized Square Aperture (ASA) Expo-Planet Imaging Space Telescope Concept

Gezari, D., NASA Goddard Space Flight Center, USA; Harwit, M., Cornell Univ., USA; Lyon, R., NASA Goddard Space Flight Center, USA; Melnick, G., Smithsonian Astrophysical Observatory, USA; Papaliolos, G., Harvard Univ., USA; Ridgeway, S., National Optical Astronomy Observatories, USA; Woodruff, R., Boeing-SVS, Inc., USA; Nisenson, P., Smithsonian Astrophysical Observatory, USA; [2002]; 1p; In English; SPIE Conference, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

ExSPO is a Discovery Class (approx. 4 meter) apodized square aperture (ASA) space telescope mission designed for direct imaging of extrasolar Earth-like planets, as a precursor to TPF. The ASA telescope concept, instrument design, capabilities, mission plan and science goals are described.

Author

Spaceborne Telescopes; Imaging Techniques

20020069082 National Defence Research Establishment, Div. of Sensor Technology, Linköping, Sweden

Statistical Analysis of Infrared Background Radiation *Statistisk Analys av Infraröd Bakgrundsstrålning*

Carlson, J.; Sep. 2001; In Swedish; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-104973; FOI-R-0184-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Radiation in the infrared region is of great importance for military surveillance. The targets as well as the background have to be characterized. To map the background FOI in Linköping has generated a database of infrared pictures in the wavelength regions 3.5-5 micro (MWIR) and 8-12 micro (LWIR). Data has been collected during one year for different kinds of weather conditions and different times of day and night. The database, that also includes weather data, has approximately 1 million infrared pictures. The pictures have been calibrated from grey-levels to radiance and have also been corrected for the influence of the atmosphere. The result is pictures showing the real levels of radiation from the background. An initial statistical analysis has been made. Mean values and standard deviation for both wavelength bands in 16 areas, that represents different types of terrain and objects in the background, have been calculated. The results have been saved as matrixes in Matlab and are easily available for further analysis. The uncertainty estimation shows that the uncertainty varies considerably due to the weather conditions. Most significant is that weather conditions with short visual range leads to high uncertainty.

NTIS

Statistical Analysis; Infrared Radiation; Background Radiation; Infrared Spectra; Calibrating

20020069092 Argonne National Lab., IL USA

New Beam Position Monitor System Design for the APS Injector

Lill, R.; Singh, O.; Arnold, N.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-43037; No Copyright; Avail: National Technical Information Service (NTIS)

Demands on the APS injector have evolved over the last few years to the point that an upgrade to the existing beam position monitor (BPM) electronics is required. The injector is presently being used as a source for both the low-energy undulator test line (LEUTL) project and the top-up mode of operation. These new requirements and the fact that many new rf receiver components are available at reasonable cost make this upgrade very desirable at this time. The receiver topology selected is a logarithmic processor, which is designed around the Analog Devices AD8313 log amplifier demodulation chip. This receiver will become the universal replacement for all injector applications measuring position signals from 352 to 2856 MHz with minimum changes in hardware and without the use of a downconverter. The receiver design features integrated front-end gain and built-in self test. The data acquisition being considered at this time is a 100-MHz, 12-bit transient recorder digitizer. The latest experimental and commissioning data and results will be presented.

NTIS

Beams (Radiation); Systems Engineering; Radio Equipment; Analog to Digital Converters

20020070290 Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

Fabrication and Metrology of High-Precision Foil Mirror Mounting Elements *Final Report, 15 Jan. 2001 - 31 Mar. 2002*

Schattenburg, Mark L., Massachusetts Inst. of Tech., USA; Aug. 18, 2002; 4p; In English

Contract(s)/Grant(s): NCC5-525

Report No.(s): MIT-OSP-6891677; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the period of this Cooperative Agreement, MIT (Massachusetts Institute of Technology) developed advanced methods for applying silicon microstructures for the precision assembly of foil x-ray optics in support of the Constellation-X Spectroscopy X-ray Telescope (SXT) development effort at Goddard Space Flight Center (GSFC). MIT developed improved methods for fabricating and characterizing the precision silicon micro-combs. MIT also developed and characterized assembly tools and several types of metrology tools in order to characterize and reduce the errors associated with precision assembly of foil

optics. Results of this effort were published and presented to the scientific community and the GSFC SXT team. A bibliography of papers and presentations is offered.

Derived from text

Bibliographies; Fabrication; Metrology; Mounting; X Ray Optics

20020070609 NASA Goddard Space Flight Center, Greenbelt, MD USA

The X-ray Mirrors for the Astro-E2 Mission

Chan, Kai-Wing, Universities Space Research Association, USA; Soong, Yang, Universities Space Research Association, USA; Serlemitsos, Peter J., NASA Goddard Space Flight Center, USA; [2002]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The X-Ray telescopes (XRT) for the US/Japan collaborative mission Astro-E2 will be of the same basic design as those built for the original Astro-E mission which failed to reach orbit in Feb. 2000. The NASA/GSFC X-ray Astrophysics Branch will again provide the five lightweight, broad-band mirrors for the mission. X-ray calibrations of the mirrors delivered for the original Astro-E instrument showed spatial resolutions characterized by Half-Power Diameters (HPD) in the range of 1.8 - 2.2 minutes of arc, essentially independent of photon energy in the soft X-ray band. For the mission Astro-E2, both funding constraints and management decisions drastically limit any design modifications, so reflector fabrication and assembly procedures have remained largely unchanged. Nevertheless, in view of the importance in scientific return of attaining even a modest improvement in the spatial resolution of these mirrors, we have carefully considered the various sources of spatial error and, whenever possible, incorporated promising modifications. In this paper, we discuss our current understanding of the various error components as well as the small changes we have been able to implement.

Author

Mirrors; X Rays; X Ray Telescopes; Calibrating; Fabrication

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

20020068015 NASA Marshall Space Flight Center, Huntsville, AL USA

Mechanisms for the Dissipation of Alfvén Waves in Near-Earth Space Plasma

Singh, Nagendra, NASA Marshall Space Flight Center, USA; Khazanov, George, NASA Marshall Space Flight Center, USA; Krivorutsky, E. N., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 Western Pacific Geophysics Meeting, 9-12 Jul. 2002, Wellington, New Zealand; No Copyright; Avail: Issuing Activity; Abstract Only

Alfvén waves are a major mechanism for the transport of electromagnetic energy from the distant part of the magnetosphere to the near-Earth space. This is especially true for the auroral and polar regions of the Earth. However, the mechanisms for their dissipation have remained illusive. One of the mechanisms is the formation of double layers when the current associated with Alfvén waves in the inertial regime interact with density cavities, which either are generated nonlinearly by the waves themselves or are a part of the ambient plasma turbulence. Depending on the strength of the cavities, weak and strong double layers could form. Such double layers are transient; their lifetimes depend on that of the cavities. Thus they impulsively accelerate ions and electrons. Another mechanism is the resonant absorption of broadband Alfvén-wave noise by the ions at the ion cyclotron frequencies. But this resonant absorption may not be possible for the very low frequency waves, and it may be more suited for electromagnetic ion cyclotron waves. A third mechanism is the excitation of secondary waves by the drifts of electrons and ions in the Alfvén wave fields. It is found that under suitable conditions, the relative drifts between different ion species and/or between electrons and ions are large enough to drive lower hybrid waves, which could cause transverse accelerations of ions and parallel accelerations of electrons. This mechanism is being further studied by means of kinetic simulations using 2.5- and 3-D particle-in-cell codes. The ongoing modeling efforts on space weather require quantitative estimates of energy inputs of various kinds, including the electromagnetic energy. Our studies described here contribute to the methods of determining the estimates of the input from ubiquitous Alfvén waves.

Author

Space Plasmas; Magnetohydrodynamic Waves; Broadband; Space Weather; Dissipation; Auroral Zones

20020068077 Chicago Univ., Labs. for Applied Sciences, Chicago, IL USA

Experimental Investigations of Transport Properties of Partially Ionized Gases Final Report

Dickerman, P. J.; Mar. 1962; 72p; In English

Contract(s)/Grant(s): AF49(638)-1033

Report No.(s): AD-A403878; LAS-TR-207-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recent advances in electric arc research and development allow stable high-temperature environments to be obtained over extended periods of time in the laboratory. by making use of the known relationships between temperature and conductivity in such are discharges and by experimentally measuring the current density, electron density, and temperature, the effective cross section of atoms which impede the electron flow can be determined. Thus, atom-electron collision cross sections can now be measured in the interesting energy range of 1 to 2 ev, lower than heretofore possible using conventional beam apparatus. Techniques involved in making the necessary spectroscopic and electrical measurements are given, and results obtained for three gases (argon, helium, and nitrogen) are presented. These results are then used to determine several of the transport properties for these partially ionized gases.

DTIC

Transport Properties; Electric Arcs; Ionized Gases

20020068812 Clarion Univ. of Pennsylvania, Physics Dept., Clarion, PA USA

Plasma Interaction with International Space Station High Voltage Solar Arrays

Heard, John W., Clarion Univ. of Pennsylvania, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXI-1 - XXI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The International Space Station (ISS) is presently being assembled in low-earth orbit (LEO) operating high voltage solar arrays (-160 V max, -140 V typical with respect to the ambient atmosphere). At the station's present altitude, there exists substantial ambient plasma that can interact with the solar arrays. The biasing of an object to an electric potential immersed in plasma creates a plasma "sheath" or non-equilibrium plasma around the object to mask out the electric fields. A positively biased object can collect electrons from the plasma sheath and the sheath will draw a current from the surrounding plasma. This parasitic current can enter the solar cells and effectively "short out" the potential across the cells, reducing the power that can be generated by the panels. Predictions of collected current based on previous high voltage experiments (SAMPIE (Solar Array Module Plasma Interactions Experiment), PASP+ (Photovoltaic Array Space Power) were on the order of amperes of current. However, present measurements of parasitic current are on the order of several milliamperes, and the current collection mainly occurs during an "eclipse exit" event, i.e., when the space station comes out of darkness. This collection also has a time scale, t approx. 1000 s, that is much slower than any known plasma interaction time scales. The reason for the discrepancy between predictions and present electron collection is not understood and is under investigation by the PCU (Plasma Contactor Unit) "Tiger" team. This paper will examine the potential structure within and around the solar arrays, and the possible causes and reasons for the electron collection of the array.

Author

Solar Arrays; Plasma Interactions; Plasma Sheaths; Electric Current; Spacecraft Charging

20020068978 NASA Goddard Space Flight Center, Greenbelt, MD USA

Integration and Test Flight Validation Plans for the Pulsed Plasma Thruster Experiment on EO- 1

Zakrzewski, Charles, NASA Goddard Space Flight Center, USA; Benson, Scott, NASA Glenn Research Center, USA; Sanneman, Paul, Swales Aerospace, USA; Hoskins, Andy, General Dynamics OTS-Aerospace, USA; [2002]; 1p; In English; 38th AIAA/ASME/SEA/ASEE Joint Propulsion Conference, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper-2002-3973; No Copyright; Avail: Issuing Activity; Abstract Only

The Pulsed Plasma Thruster (PPT) Experiment on the Earth Observing One (EO-1) spacecraft has been designed to demonstrate the capability of a new generation PPT to perform spacecraft attitude control. The PPT is a small, self-contained pulsed electromagnetic propulsion system capable of delivering high specific impulse (900-1200 s), very small impulse bits (10-1000 μ N-s) at low average power (less than 1 to 100 W). Teflon fuel is ablated and slightly ionized by means of a capacitive discharge. The discharge also generates electromagnetic fields that accelerate the plasma by means of the Lorentz Force. EO-1 has a single PPT that can produce thrust in either the positive or negative pitch direction. The flight validation has been designed

to demonstrate of the ability of the PPT to provide precision pointing accuracy, response and stability, and confirmation of benign plume and EMI effects. This paper will document the success of the flight validation.

Author

Performance Tests; Flight Envelopes; Pulsed Plasma Thrusters; Attitude Control; Spacecraft Control

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20020067751 NASA Marshall Space Flight Center, Huntsville, AL USA

The Traps of Using Conventional Methodology of Evaluation of Powder Diffractograms for Determination of the Lattice Parameters of Nanocrystals

Palosz, Bogdan, Polish Academy of Sciences, Poland; Grzanka, Ewa, Polish Academy of Sciences, Poland; Stelmach, Svetlana, Polish Academy of Sciences, Poland; Gierlotka, Stanislaw, Polish Academy of Sciences, Poland; Palosz, Witold, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The inherent errors introduced by the algorithm of standard procedures of evaluation of powder diffractograms of nanopowders are shown. The implications of the errors are discussed and illustrated based on the results reported in the literature.

Author

Evaluation; Powder (Particles); Diffractometers; Diagrams; Lattice Parameters

20020068018 Virginia Commonwealth Univ., Richmond, VA USA

A Frontal Attack on Limiting Defects in GaN Final Report, 29 Sep. 1999-30 Dec. 2001

Morkoc, Hadis; Jul. 15, 2002; 56p; In English

Contract(s)/Grant(s): N00014-99-1-1067; Proj-01PR04847-00

Report No.(s): AD-A404052; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

GaN community, particularly under the leadership of Drs. Wood, Win, and Litton, recognized that it is imperative that the extended, and point defects in GaN and related materials, and the mechanisms for their formation are understood. This is a first and an important step, which must be followed by defect reduction before full implementation of this material and its allied binaries/ternaries in devices. to establish benchmarks and identify the basic issues involved, a group of experts have joined forces to first fully characterize the HVPE grown material followed by attempts to find ways to reduce the defects an impurities in GaN in the outlying years. The group consisted of R. Molnar of Lincoln Labs, Dave Look of Wright State University, Jaime Freitas of NRL, Chris Van de Walle of Xerox PARC, L. Chemyak of UCF, Fred Pollak of Brooklyn College, Zuzanna Lilliental_Weber of LBNL, K. Saarinen of Helsinki University of Technology, L. Brillson of OSU, and Hadis Morkoc of VCU. There were others who performed related research, but their work is not included here.

DTIC

Point Defects; Gallium Nitrides

20020068021 Northwestern Univ., Evanston, IL USA

Instrumentation for Integrated Photonic Device Research Final Report, 1 May 2000-30 Apr. 2001

Wessels, Bruce; Apr. 2001; 3p; In English

Contract(s)/Grant(s): F49620-00-1-0262; AF Proj. 3484

Report No.(s): AD-A404059; AFRL-SR-AR-TR-02-0218; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The system is currently operational and has been used in support of the AFOSR MURI program on Integrated Devices for Terabit per Second Network Applications, under award no. F49620-0262/005 monitored by AFOSR.

DTIC

Integrated Circuits; Photonics; Instruments

20020068029 University of Southern California, Dept. of Materials Science and Engineering, Los Angeles, CA USA
Process Modeling and In-Situ Sensor Feedback Based Adaptive Control of Molecular Beam Epitaxy and Ion-Assisted Reactive Etching of Advanced Semiconductor Structures *Final Report, 1 July 1995-30 June 2001*

Madhukar, A.; Rosen, I. G.; Kalia, R. K.; Vashishta, P.; Wang, C.; Jun. 30, 2001; 12p; In English

Contract(s)/Grant(s): F49620-95-1-0452

Report No.(s): AD-A403891; AFRL-SR-AR-TR-02-0210; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document summarizes the salient features of the accomplishments made during the period July 1, 1999 - June 30, 2001, of the above-titled MURI grant. The accomplishments include: (1) design and successful experimental implementation of single input (microwave power) adaptive real-time control of CF₄/O₂ plasma etching of Si(x)N(sub y) utilizing spectroscopic ellipsometry sensor feedback; (2) development of highly efficient dynamic load balancing, low overhead, and scalable algorithm to carry out atomistic simulations on massively parallel computing platforms and its testing for systems up to a billion atoms; (3) multi-resolution molecular-dynamics simulations of atomic scale stress distributions and dislocation propagation in Si/Si₃N₄ nanopixels with up to 27 million atoms; (4) developed a reflection-high-energy electron diffraction in-situ sensor based machine condition transfer function for reproducibility of molecular beam epitaxy (MBE) growth conditions; (5) examination of MBE growth on patterned surfaces and the role of surface stress engineering to achieve spatially selective growth of quantum dots; (6) large scale molecular dynamics simulations of bare and overlayer covered nanoscale square mesas of the Ge/Si (001) and InAs/GaAs (001) systems; (7) evidence from the InAs on GaAs (001) simulated stress relaxation for the observed self-limiting InAs overlayer thickness on GaAs nanomesas.

DTIC

Molecular Beam Epitaxy; Semiconductors (Materials); Plasma Etching

20020068384 Columbia Univ., Dept. of Electrical Engineering, New York, NY USA

Large Area Heteroepitaxial Growth Using Compliant Substrates *Final Report, 31 Jul. 1996-1 Dec. 2001*

Wang, Wen I.; Jul. 02, 2002; 20p; In English

Contract(s)/Grant(s): N00014-96-1-1179

Report No.(s): AD-A403964; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In situ relaxed SiGe epitaxial layers with low threading dislocation densities grown on compliant Si-on-insulator substrates was achieved. The first semi-quantitative theory for the mechanism of the reduction of dislocation density in epilayers grown on compliant substrates was developed. High mobility two-dimensional electrons in AlGa_N/Ga_N heterostructures were prepared on sapphire substrates by molecular beam epitaxy (MBE). Sb was used for the first time as surfactant to improve the growth of Ga_N. Also reported are many firsts, including the exploitation of strain-modulated epitaxy, the use of LGO substrate for Ga_N substrate removal, and the demonstration of Ga_N devices bonded to Si enabled by bonded substrate removal.

DTIC

Substrates; Germanium; Epitaxy; Crystal Growth; SOI (Semiconductors)

20020068567 NASA Marshall Space Flight Center, Huntsville, AL USA

Phase Sensitive X-Ray Diffraction Imaging of Defects in Biological Macromolecular Crystals

Hu, Z. W., NASA Marshall Space Flight Center, USA; Lai, B., Argonne National Lab., USA; Chu, Y. S., Argonne National Lab., USA; Cai, Z., Argonne National Lab., USA; Mancini, D. C., Argonne National Lab., USA; Thomas, B. R., NASA Marshall Space Flight Center, USA; Chernov, A. A., NASA Marshall Space Flight Center, USA; 20020101; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Characterization of defects and/or disorder in biological macromolecular crystals presents much greater challenges than in conventional small-molecule crystals. The lack of sufficient contrast of defects is often a limiting factor in x-ray diffraction topography of protein crystals. This has seriously hampered efforts to understand mechanisms and origins of formation of imperfections, and the role of defects as essential entities in the bulk of macromolecular crystals. In this report, we employ a phase sensitive x-ray diffraction imaging approach for augmenting the contrast of defects in protein crystals.

Derived from text

Crystals; Crystal Defects; Proteins; X Ray Diffraction; Topography; Crystallography

20020068816 Indiana Univ. of Pennsylvania, Physics Dept., Indiana, PA USA

An Atomistic Simulation of Crack Propagation in a Nickel Single Crystal

Karimi, Majid, Indiana Univ. of Pennsylvania, USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXVI-1 - XXVI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The main objective of this paper is to determine mechanisms of crack propagation in a nickel single crystal. Motivation for selecting nickel as a case study is because we believe that its physical properties are very close to that of nickel-base super alloy. We are directed in identifying some generic trends that would lead a single crystalline material to failure. We believe that the results obtained here would be of interest to the experimentalists in guiding them to a more optimized experimental strategy. The dynamic crack propagation experiments are very difficult to do. We are partially motivated to fill the gap by generating the simulation results in lieu of the experimental ones for the cases where experiment can not be done or when the data is not available.

Derived from text

Molecular Dynamics; Mathematical Models; Nickel; Single Crystals; Crack Propagation

20020068953 National Inst. of Standards and Technology, (MSEL), Gaithersburg, MD USA

Fundamentals of Neutron Powder Diffraction. NIST Recommended Practice Guide

Copley, J. R. D.; Nov. 2001; 46p; In English

Report No.(s): PB2002-106304; NIST/SP-960-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract available.

NTIS

Neutron Diffraction; Powder (Particles)

20020068966 Argonne National Lab., IL USA

Ion-Beam-Assisted Deposition of Magnesium Oxide Films for Coated Conductors

Weber, T. P.; Ma, B.; Balachandran, U.; McNallan, M.; 2002; 12p; In English

Report No.(s): DE2002-42850; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The development of high critical-temperature thin-film superconductors and coated conducting wires is important for electric power applications. To achieve high transport current density, template films are necessary for the successful deposition of biaxially aligned YBa₂Cu₃O(7-x) (YBCO) on flexible metal substrates. We grew biaxially aligned magnesium oxide (MgO) template films by ion-beam-assisted deposition with electron-beam evaporation. MgO films of approximately 100 angstroms thickness were deposited on Si₃N₄-coated Si substrates at a deposition rate of approximately 1.5 angstroms/sec with an ion flux of approximately 110 microA/sq cm bombarding the substrate at a 45 degree angle. to study crystalline structure by X-ray diffraction, we deposited an additional layer of MgO. Good in- and out-of-plane alignment was observed, with (111) -scan full-width half-maximum (FWHM) of 6.2 degrees and (002) micro-scan FWHM of 2.2 degrees.

NTIS

Ion Beams; X Ray Diffraction; Superconducting Films; High Temperature Superconductors

20020068981 NASA Ames Research Center, Moffett Field, CA USA

The Surface Interface Characteristics of Vertically Aligned Carbon Nanotube and Graphitic Carbon Fiber Arrays Grown by Thermal and Plasma Enhanced Chemical Vapor Deposition

Delzeit, Lance, NASA Ames Research Center, USA; Nguyen, Cattien, NASA Ames Research Center, USA; Li, Jun, NASA Ames Research Center, USA; Han, Jie, NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; [2002]; 1p; In English; MRS 2002 Spring Meeting, 1-5 Apr. 2002, San Francisco, CA, USA; Sponsored by Materials Research Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The development of nano-arrays for sensors and devices requires the growth of arrays with the proper characteristics. One such application is the growth of vertically aligned carbon nanotubes (CNTs) and graphitic carbon fibers (GCFs) for the chemical attachment of probe molecules. The effectiveness of such an array is dependent not only upon the effectiveness of the probe and the interface between that probe and the array, but also the array and the underlying substrate. If that array is a growth of vertically aligned CNTs or GCFs then the attachment of that array to the surface is of the utmost importance. This attachment provides the mechanical stability and durability of the array, as well as, the electrical properties of that array. If the detection is to be acquired through an electrical measurement, then the appropriate resistance between the array and the surface need to be fabricated into the device. I will present data on CNTs and GCFs grown from both thermal and plasma enhanced chemical vapor deposition. The focus will be on the characteristics of the metal film from which the CNTs and GCFs are grown and the changes that occur due to changes within the growth process.

Author

Carbon Fibers; Carbon Nanotubes; Nanostructure Growth; Metal Films

20020068990 Argonne National Lab., IL USA

Studies of Grain Boundaries in Melt Textured YBa(2)Cu(3)O(x)

Veal, B. W.; Claus, H.; Chen, L.; Paulikas, A. P.; 2002; 20p; In English

Report No.(s): DE2002-43048; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tilt grain boundaries were studied in bi-crystal samples of melt textured YBa(sub 2)Cu(sub 3)O(sub x). Grain boundary critical current densities J(sub CB) were obtained from SQUID magnetization measurements on ring samples that contain the grain boundary. The dependence of JCB on oxygen stoichiometry and oxygen ordering were investigated and preliminary studies of grain boundary doping with selected cations, including Ca, SR, and Bi were undertaken.

NTIS

Grain Boundaries; Copper Oxides; Barium Oxides; Yttrium Oxides

20020069147 Argonne National Lab., Chemical Technology Div., IL USA

Inclined Substrate Pulsed Laser Deposition of YBCO Thin Films on Polycrystalline AG Substrates

Li, M.; Ma, B.; Koritala, R. E.; Fisher, B. L.; Dorris, S. E.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-42878; No Copyright; Avail: National Technical Information Service (NTIS)

A promising material for future electric power applications is YBa(2)Cu(3)O(7-x) (YBCO)-coated conductors. Recently, YBCO thin films grown on silver tapes have attracted much interest because of their high superconducting transition temperature (Tc) and high critical current density (Jc). Silver is an ideal substrate candidate due to its compatibility with YBCO and its inertness to oxidation. The electrical properties have been improved in the YBCO films by silver doping up to 20 at.%. Unlike other substrate materials such as Ni-based alloys, in which buffer layers are necessary to prevent Ni diffusion into the YBCO film, YBCO can be directly deposited on silver substrate without a buffer layer.

NTIS

Lasers; Thin Films; Yttrium Oxides; Barium Oxides; Copper Oxides; Polycrystals; Electrical Properties

20020070269 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Investigation of Defects and Surface Polarity in GaN Using Hot Wet Etching Together with Microscopy and Diffraction Techniques

Visconti, P.; Huang, D.; Reschikov, M. A.; Yun, F.; Smith, J.; 2002; 14p; In English

Report No.(s): DE2002-795351; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The availability of reliable and quick methods to determine defect density and polarity in GaN films is of great interest. We have used photo-electrochemical (PEC) and hot wet etching using H3PO4 and molten KOH to estimate the defect density in GaN films grown by hydride vapor phase epitaxy (HVPE) and molecular beam epitaxy (MBE). Free-standing whiskers and hexagonal etch pits are formed by PEC and wet etching respectively. Using Atomic Force Microscopy (AFM), we found the whisker density to be similar to etch pit densities for samples etched under precise conditions. Additionally Transmission Electron Microscopy (TEM) observations confirmed dislocation densities obtained by etching which increased our confidence in the consistency of methods used. Hot wet etching was used also to investigate the polarity of GaN films together with Convergent Beam Electron Diffraction (CBED) and AFM imaging. We found that hot H3PO4 etches N-polarity GaN films very quickly resulting in the complete removal or drastic change of surface morphology as revealed by AFM or optical microscopy. On the contrary, the acid attacks only defect sites in Ga-polarity films producing nanometer-scale pits but leaving the defect-free GaN intact and the morphology unchanged. Additionally, the polarity assignments were related to the as-grown morphology and to the growth conditions of the buffer layer and the subsequent GaN layer.

NTIS

Gallium Nitrides; Crystal Defects; Polarity; Conferences; Transmission Electron Microscopy; Atomic Force Microscopy

20020070274 California Univ., Berkeley, CA USA

Liquid Phase Epitaxial Growth and Characterization of Germanium Far Infrared Blocked Impurity Band Detectors

Bandaru, J.; 2001; 114p; In English

Report No.(s): DE2002-795481; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

No abstract available.

NTIS

Liquid Phase Epitaxy; Germanium; Hall Effect; Far Infrared Radiation

20020070275 California Univ., Lawrence Berkeley National Lab., Materials Science Div., Berkeley, CA USA

Microstructures of GaN and In(x)Ga(1-x)N Films Grown by MOCVD on Freestanding GaN Templates

Jasinski, J.; Liliental-Weber, Z.; Huan, D.; Reshchikov, M. A.; Yun, F.; 2002; 16p; In English

Report No.(s): DE2002-795385; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We summarize structural properties of thick HVPE GaN templates from the point of view of their application as substrates for growth of nitride layers. This is followed by the results of optical and structural studies, mostly transmission electron microscopy, of nitride layers grown by MOCVD on top of the HVPE substrates.

NTIS

Gallium Nitrides; Microstructure; Transmission Electron Microscopy

20020070276 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Superior Structural Quality of Newly Developed GaN Pendeo-Epitaxial Layers

Liliental-Weber, L.; Jasinski, J.; Cherns, D.; Baines, M.; Davis, R.; 2002; 10p; In English

Report No.(s): DE2002-795375; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Transmission electron microscopy of plan-view and cross-section samples of pendeo-epitaxial layers is described. Samples grown with and without silicon nitride masks are compared. A large misorientation of the GaN grown above the mask was observed, with 2-3 degrees tilt between wing and seed areas, caused by additional nucleation on the mask layer. Some misorientation was also observed between wing/wing areas of the sample. Samples grown without silicon nitride masks show much smaller misorientations and contain different types of defects.

NTIS

Gallium Nitrides; Epitaxy; Defects; Silicon Nitrides

20020070285 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Electro-mechanical Properties of Carbon Nanotubes: Effect of Small Tensile and Torsional Strains

Anantram, M. P., NASA Ames Research Center, USA; Yang, Liu, NASA Ames Research Center, USA; Han, Jie, NASA Ames Research Center, USA; Liu, J. P., NASA Ames Research Center, USA; [1999]; 1p; In English; American Physical Society Meeting, 20-26 Mar. 1999, Atlanta, GA, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

We present a simple picture to calculate the bandgap (E_g) of carbon nanotubes (CNT) in the presence of uniform torsional and tensile strain (σ). We find that under tensile strain, the absolute value of $dE_g/d\sigma$ of zig-zag tubes is approximately equal to $3t_0$, where t_0 is the hopping parameter. Further, the absolute value of $dE_g/d\sigma$ decreases as the chirality changes to armchair, where it takes the value zero. The sign of $dE_g/d\sigma$ follows the $(N_x - N_y) \bmod 3$ (equal to -1, 0 and +1) rule. In contrast to the above, we show that under torsional strain, the absolute value of $dE_g/d\sigma$ of armchair tubes is approximately equal to $3t_0$ and continually decreases as the chirality changes to zig-zag, where it takes a small value. The sign of $dE_g/d\sigma$ again follows the $(N_x - N_y) \bmod 3$ rule. Finally, we predict a change in the sign of $dE_g/d\sigma$ as function of strain, corresponding to a change in the value of q that corresponds to the bandgap minimum.

Author

Computation; Carbon Nanotubes; Energy Gaps (Solid State)

20020070291 NASA Ames Research Center, Moffett Field, CA USA

Electro-mechanical Properties of Carbon Nanotubes

Anantram, M. P., NASA Ames Research Center, USA; Yang, Liu, MRJ Technology Solutions, Inc., USA; Han, Jie, MRJ Technology Solutions, Inc., USA; Liu, J. P., MRJ Technology Solutions, Inc., USA; [1998]; 1p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

We present a simple picture to understand the bandgap variation of carbon nanotubes with small tensile and torsional strains, independent of chirality. Using this picture, we are able to predict a simple dependence of $d(\text{Bandgap})/d(\text{strain})$ on the value of $(N_x - N_y) \bmod 3$, for semiconducting tubes. We also predict a novel change in sign of $d(\text{Bandgap})/d(\text{strain})$ as a function of tensile strain arising from a change in the value of q corresponding to the minimum bandgap. These calculations are complemented by calculations of the change in bandgap using energy minimized structures, and some important differences are discussed. The calculations are based on the \bar{S}_i electron approximation.

Author

Energy Gaps (Solid State); Carbon Nanotubes; Electromechanical Devices

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20020068792 Alabama Univ., Huntsville, AL USA

Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program *Final Report*

Karr, G., Editor, Alabama Univ., USA; Pruitt, J., Editor, NASA Marshall Space Flight Center, USA; Nash-Stevenson, S., Editor, NASA Marshall Space Flight Center, USA; Freeman, L. M., Editor, Alabama Univ., USA; Karr, C. L., Editor, Alabama Univ., USA; July 2002; 322p; In English; Also announced as 20020068793 through 20020068841

Contract(s)/Grant(s): NAG8-1786

Report No.(s): NASA/CR-2002-211840; M-1054; NAS 1.26:211840; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

For the thirty-seventh consecutive year, a NASA/ASEE (American Society for Engineering Education) Summer Faculty Fellowship Program was conducted at Marshall Space Flight Center (MSFC). The program was conducted by The University of Alabama in Huntsville and MSFC during the period May 29 - August 3, 2001. Operated under the auspices of the American Society for Engineering Education, the MSFC program, as well as those at other NASA Centers, was sponsored by the University Affairs Office, NASA Headquarters, Washington, DC. The basic objectives of the programs, which are in the thirty-seventh year of operation nationally, are (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of the participants' institutions; and (4) to contribute to the research objectives of the NASA Centers. The Faculty Fellows spent ten weeks at MSFC engaged in a research project compatible with their interests and background and worked in collaboration with a NASA MSFC colleague. This document is a compilation of Fellows' reports on their research during the summer of 2001.

Author

University Program; Education; Summer; NASA Programs

20020068813 Langston Univ., Dept. of Mathematics, Langston, OK USA

Processes and Procedures of the Higher Education Programs at Marshall Space Flight Center

Heard, Pamela D., Langston Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXII-1 - XXII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The purpose of my research was to investigate the policies, processes, procedures and timelines for the higher education programs at Marshall Space Flight Center. The three higher education programs that comprised this research included: the Graduate Student Researchers Program (GSRP), the National Research Council/Resident Research Associateships Program (NRC/RRA) and the Summer Faculty Fellowship Program (SFFP). The GSRP award fellowships each year to promising U.S. graduate students whose research interest coincides with NASA's mission. Fellowships are awarded for one year and are renewable for up to three years to competitively selected students. Each year, the award provides students the opportunity to spend a period in residence at a NASA center using that installation's unique facilities. This program is renewable for three years, students must reapply. The National Research Council conducts the Resident Research Associateships Program (NRC/RRA), a national competition to identify outstanding recent postdoctoral scientists and engineers and experience senior scientists and engineers, for tenure as guest researchers at NASA centers. The Resident Research Associateship Program provides an opportunity for recipients of doctoral degrees to concentrate their research in association with NASA personnel, often as a culmination to formal career preparation. The program also affords established scientists and engineers an opportunity for research without any interruptions and distracting assignments generated from permanent career positions. All opportunities for research at NASA Centers are open to citizens of the U.S. and to legal permanent residents. The Summer Faculty Fellowship Program (SFFP) is conducted each summer. NASA awards research fellowships to university faculty through the NASA/American Society for Engineering Education. The program is designed to promote an exchange of ideas between university faculties, NASA scientists and engineers. Selected participants in fields of science, engineering, math, and other disciplines spend approximately 10 weeks working with their professional peers on research projects at NASA facilities. Workshops and seminars further enrich the experience. This program is only for U.S. citizens.

Author

Education; Universities; Students; NASA Programs; Research Facilities

20020070377 NASA Ames Research Center, Moffett Field, CA USA

Using an Ongoing Study of Terrestrial Plant Response to Ultraviolet Radiation in Project ALERT

Condon, Estelle, NASA Ames Research Center, USA; Skiles, J. W., NASA Ames Research Center, USA; Seitz, Jeffery C., NASA

Ames Research Center, USA; Dantoni, Hector L., NASA Ames Research Center, USA; Nov. 18, 1998; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The ALERT (Augmented Learning Environment for Renewable Teaching) Project is a cooperative California-based program with two main partners: California State University (CSU) geoscience and education departments and two NASA Centers, the Jet Propulsion Laboratory (JPL) in Pasadena and the Ames Research Center (ARC) in Mountain View. This paper presents an example of how a NASA research effort can be used in the undergraduate classroom. A study, now in the fourth year, subjects test plants to exposures of varying solar ultraviolet (UV) radiation (280 - 340 nm); a full solar UV exposure, a solar UV exposure less about 14% of ambient UV flux, and a UV-blocked regime. This experiment is simple in that only modest amounts of expense are required yet it is elegant since only one variable, UV-flux is involved. The experiment lends itself to teaching several of the Earth Sciences because it uses information from botany, taxonomy, and ecology. Aspects of physics are inherent in the study since portions of the electromagnetic spectrum are studied. Further, since only one of many variables are manipulated, UV flux, the study demonstrates how the scientific method is used in formulating and testing hypotheses. Based on the ALERT experience this summer, this study will be implemented at a CSU campus with the expectation that it will serve as a pedagogical tool and where it will involve students in actual research.

Author

Ultraviolet Radiation; Earth Sciences; Education; Solar Radiation

20020070383 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Imagine the Universe! E/PO Program

Lochner, James C., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; NASA OSS Education/Outreach Conference, 12-22 Jun. 2002, Chicago, IL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Since 1996, the Imagine the Universe! E/PO program has brought information and curriculum support materials to upper middle school, high school, and lower undergraduate students and their teachers on topics in the Structure and Evolution of the Universe (SEU) theme. The Imagine E/PO program consists of a web site, a series of posters and information/activity booklets, and a repertoire of educator workshops. We involve both scientists and educators in the development and testing of the materials. We describe here the various aspects of this program.

Author

Education; Evolution (Development); Universe; NASA Programs

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20020068807 Alabama Univ., Industrial and Systems Engineering and Engineering Management, Huntsville, AL USA

ISO 9000 and/or Systems Engineering Capability Maturity Model?

Gholston, Sampson E., Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XVI-1 - XVI-5; In English; Also announced as 20020068792

Contract(s)/Grant(s): NAG8-1786; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

For businesses and organizations to remain competitive today they must have processes and systems in place that will allow them to first identify customer needs and then develop products/processes that will meet or exceed the customers needs and expectations. Customer needs, once identified, are normally stated as requirements. Designers can then develop products/processes that will meet these requirements. Several functions, such as quality management and systems engineering management are used to assist product development teams in the development process. Both functions exist in all organizations and both have a similar objective, which is to ensure that developed processes will meet customer requirements. Are efforts in these organizations being duplicated? Are both functions needed by organizations? What are the similarities and differences between the functions listed above? ISO 9000 is an international standard of goods and services. It sets broad requirements for the assurance of quality and for management's involvement. It requires organizations to document the processes and to follow these documented processes. ISO 9000 gives customers assurance that the suppliers have control of the process for product development. Systems engineering can broadly be defined as a discipline that seeks to ensure that all requirements for a system are satisfied throughout the life of the system by preserving their interrelationship. The key activities of systems engineering include requirements analysis, functional analysis/allocation, design synthesis and verification, and system analysis and control. The systems engineering process, when followed properly, will lead to higher quality products, lower cost products, and shorter development cycles. The System Engineering Capability Maturity Model (SE-CMM) will allow companies to measure their

system engineering capability and continuously improve those capabilities. ISO 9000 and SE-CMM seem to have a similar objective, which is to document the organization's processes and certify to potential customers the capability of a supplier to control the processes that determine the quality of the product or services being produced. The remaining sections of this report examine the differences and similarities between ISO 9000 and SE-CMM and make recommendations for implementation.

Author

Standards; Systems Engineering; Engineering Management; Quality Control

20020068814 Motlow State Community Coll., Business Information Systems, Tullahoma, TN USA

Implementing a Workforce Development Pipeline

Hix, Billy, Motlow State Community Coll., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXIII-1 - XXIII-19; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Research shows that the number of highly trained scientists and engineers has continued a steady decline during the 1990's. Furthermore, at the high school level, almost 40% of the total high school graduates are seeking technical skills in preparation of entering the workforce directly. The decrease of students in technology and science programs, along with the lack of viable vocational programs, haunts educators and businesses alike. However, MSFC (Marshall Space Flight Center) has the opportunity to become a leading edge model of workforce development by offering a unified program of apprenticeships, workshops, and educational initiatives. These programs will be designed to encourage young people of all backgrounds to pursue the fields of technology and science, to assist research opportunities, and to support teachers in the systemic changes that they are facing. The emphasis of our program based on grade levels will be: Elementary Level: Exposure to the workforce. Middle School: Examine the workforce. High School and beyond: Instruct the workforce. It is proposed that MSFC create a well-integrated Workforce Development Pipeline Program. The program will act to integrate the many and varied programs offered across MSFC directorates and offices. It will offer a clear path of programs for students throughout middle school, high school, technical training, and college and universities. The end result would consist of technicians, bachelors degrees, masters degrees, and PhDs in science and engineering fields entering the nation's workforce, with a focus on NASA's future personnel needs.

Derived from text

Students; Schools; Aerospace Industry; Personnel; Education; Occupation

20020068831 Alabama Univ., Dept. of Industrial Engineering, AL USA

Application of Risk Assessment Tools in the Continuous Risk Management (CRM) Process

Ray, Paul S., Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLIV-1 - XLIV-6; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Marshall Space Flight Center (MSFC) of the National Aeronautics and Space Administration (NASA) is currently implementing the Continuous Risk Management (CRM) Program developed by the Carnegie Mellon University and recommended by NASA as the Risk Management (RM) implementation approach. The four most frequently used risk assessment tools in the center are: (a) Failure Modes and Effects Analysis (FMEA), Hazard Analysis (HA), Fault Tree Analysis (FTA), and Probabilistic Risk Analysis (PRA). There are some guidelines for selecting the type of risk assessment tools during the project formulation phase of a project, but there is not enough guidance as to how to apply these tools in the Continuous Risk Management process (CRM). But the ways the safety and risk assessment tools are used make a significant difference in the effectiveness in the risk management function. Decisions regarding, what events are to be included in the analysis, to what level of details should the analysis be continued, make significant difference in the effectiveness of risk management program. Tools of risk analysis also depends on the phase of a project e.g. at the initial phase of a project, when not much data are available on hardware, standard FMEA cannot be applied; instead a functional FMEA may be appropriate. This study attempted to provide some directives to alleviate the difficulty in applying FTA, PRA, and FMEA in the CRM process. Hazard Analysis was not included in the scope of the study due to the short duration of the summer research project.

Author

Assessments; Risk; NASA Programs; Safety

20020068837 Mississippi State Univ., Dept. of Industrial Engineering, MS USA

An Evaluation of the ROSE System

Usher, John M., Mississippi State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. LI-1 - LI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

A request-oriented scheduling engine, better known as ROSE, is under development within the Flight Projects Directorate for the purpose of planning and scheduling of the activities and resources associated with the science experiments to be performed

aboard the International Space Station (ISS). ROSE is being designed to incrementally process requests from payload developers (PDs) to model and schedule the execution of their science experiments on the ISS. The novelty of the approach comes from its web-based interface permitting the PDs to define their request via the construction of a graphical model to represent their requirements. Based on an examination of the current ROSE implementation, this paper proposes several recommendations for changes to the modeling component and makes mention of other potential applications of the ROSE system.

Author

International Space Station; Scheduling; Payloads

20020070178 NASA, Washington, DC USA

ASK Magazine, No. 7

Post, Todd, Editor, EduTech Ltd., USA; Laufer, Alexander, Editor, NASA, USA; Collins, Michelle, Editor, NASA, USA; March 2002; 53p; In English; Also announced as 20020070179 through 20020070190; Original contains color illustrations

Report No.(s): NASA/NP-2002-04-286-HQ; NAS 1.83:04-286-HQ; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

What makes a successful team? In this issue our contributors look closely at the subject and come up with several answers. Working on team chemistry is the "Activation Energy" Dr. Owen Gaden's story is about. Scott Cameron thinks it's getting to know people one to one. Tony Maturo says it's getting the most out of your support staff. Dr. Michael Hecht finds the best people he can and build the team around their talents. Teamwork is a theme we explore often in Academy Sharing Knowledge (ASK), but never so directly as in this issue. You'll not only find formulas for building successful teams, you'll see examples of ones in action, strategies for how project managers can motivate their teams, and expert advice on how to choose who to work with and who not to work with. It seems like all the stories make one common point: everyone on a team counts. Few project managers can pull off a project alone, and when the whole team is performing to everyone's potential, the chances of pulling off a successful project goes up exponentially. If that doesn't seem like enough by itself, listen to this... Discerning fans of ASK will note the last two issues our Special Feature was "There are no Mistakes, Only Lessons." We have not abandoned this feature, but for now we want to broaden our repertoire. In this issue we add a new Special Feature, "My Metaphor," starting with Paul Espinosa's article "My Big Wall" about his rock climbing adventures on El Capitan in Yosemite National Park. If you think getting to Mars is work, read what it's like to scale a 3,000-foot rock face. This issue we're also welcoming two new members to our Review Board, Hugh Woodward and Jody Kusek. Hugh and Jody are our first reviewers from outside NASA, and we are delighted to have them on our team. Read their bios on the ASK Review Board page and see why we feel privileged to have them on our team.

Derived from text

Literature; Project Management; Personnel Management; Teams

20020070179 NASA, Washington, DC USA

Sounds like Team Spirit

Hoffman, Edward, NASA, USA; ASK Magazine; March 2002, No. 7, pp. 4-5; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

I recently accompanied my son Dan to one of his guitar lessons. As I sat in a separate room, I focused on the music he was playing and the beautiful, robust sound that comes from a well-played guitar. Later that night, I woke up around 3 am. I tend to have my best thoughts at this hour. The trouble is I usually roll over and fall back asleep. This time I was still awake an hour later, so I got up and jotted some notes down in my study. I was thinking about the pure, honest sound of a well-played instrument. From there my mind wandered into the realm of high-performance teams and successful projects. (I know this sounds weird, but this is the sort of thing I think about at 3 am. Maybe you have your own weird thoughts around that time.) Consider a team in relation to music. It seems to me that a crack team can achieve a beautiful, perfect unity in the same way that a band of brilliant musicians can when they're in harmony with one another. With more than a little satisfaction I have to admit, I started to think about the great work performed for you by the Knowledge Sharing team, including this magazine you are reading. Over the past two years I personally have received some of my greatest pleasures as the APPL Director from the Knowledge Sharing activities - the Masters Forums, NASA Center visits, ASK Magazine. The Knowledge Sharing team expresses such passion for their work, just like great musicians convey their passion in the music they play. In the case of Knowledge Sharing, there are many factors that have made this so enjoyable (and hopefully worthwhile for NASA). Three ingredients come to mind -- ingredients that have produced a signature sound. First, through the crazy, passionate playing of Alex Laufer, Michelle Collins, Denise Lee, and Todd Post, I always know that something startling and original is going to come out of their activities. This team has consistently done things that are unique and innovative. For me, best of all is that they are always trying to improve on what they've done before. Second, success in any endeavor stems from people who know how to interpret a composition to sound beautiful when played in a different style. For Knowledge Sharing to work, it must be adapted, reinterpreted, shaped and played with at the centers. In this regard, we've

been blessed with another crazy, passionate, inspired artist named Claire Smith. Claire has turned Ames Research Center in California into APPL-west. She is so good and committed to what she does that I just refer people to her whenever they have questions about implementing project management development at the field level. Finally, any great effort requires talented people working behind the scenes, the people who formulate a business approach and know how to manage the money so that the music gets heard. I have known many brilliant and creative people with a ton of ideas that never take off due to an inability to work the business. Again, the Knowledge Sharing team has been fortunate to have competent and passionate people, specifically Tony Maturo and his procurement team at Goddard Space Flight Center, to make sure the process is in place to support the effort. This kind of support is every bit as crucial as the activity itself, and the efforts and creativity that go into successful procurement and contracting is a vital ingredient of this successful team.

Derived from text

Project Management; Leadership; Knowledge

20020070180 NASA, Washington, DC USA

A "Sweet 16" of Rules About Teamwork

Laufer, Alexander, Editor, NASA, USA; ASK Magazine; March 2002, No. 7, pp. 6-8; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The following "Sweet 16" rules included in this paper derive from a longer paper by APPL Director Dr. Edward Hoffman and myself entitled "99 Rules for Managing Faster, Better, Cheaper Projects." Our sources consisted mainly of "war stories" told by master project managers in my book *Simultaneous Management: Managing Projects in a Dynamic Environment* (AMACOM, The American Management Association, 1996). The Simultaneous Management model was a result of 10 years of intensive research and testing conducted with the active participation of master project managers from leading private organizations such as AT&T, DuPont, Exxon, General Motors, IBM, Motorola and Procter & Gamble. In a more recent study, led by Dr. Hoffman, we learned that master project managers in leading public organizations employ most of these rules as well. Both studies, in private and public organizations, found that a dynamic environment calls for dynamic management, and that is especially clear in how successful project managers think about their teams.

Derived from text

Project Management; Organizations; Teams

20020070181 Defense Systems Management School, Fort Belvoir, VA USA

Activation Energy

Gadeken, Owen, Defense Systems Management School, USA; ASK Magazine; March 2002, No. 7, pp. 9-11; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Teaming is so common in today's project management environment that most of us assume it comes naturally. We further assume that when presented with meaningful and challenging work, project teams will naturally engage in productive activity to complete their tasks. This assumption is expressed in the simple (but false) equation: Team + Work = Teamwork. Although this equation appears simple and straightforward, it is far from true for most project organizations whose reality is a complex web of institutional norms based on individual achievement and rewards. This is illustrated by the very first successful team experience from my early Air Force career. As a young lieutenant, I was sent to Squadron Officer School, which was the first in the series of Air Force professional military education courses I was required to complete during my career. We were immediately formed into teams of twelve officers. Much of the course featured competition between these teams. As the most junior member of my team, I quickly observed the tremendous pressure to show individual leadership capability. At one point early in the course, almost everyone in our group was vying to become the team leader. This conflict was so intense that it caused us to fail miserably in our first outdoor team building exercise. We spent so much time fighting over leadership that we were unable to complete any of the events on the outdoor obstacle course. This complete lack of success was so disheartening to me that I gave our team little hope for future success. What followed was a very intense period of bickering, conflict, and even shouting matches as our dysfunctional team tried to cope with our early failures and find some way to succeed. British physician and researcher Wilfred Bion (*Experiences in Groups*, 1961) discovered that there are powerful psychological forces inherent in all groups that divert from accomplishing their primary tasks. To overcome these restraining forces and use the potential power of the team, greater emphasis must be placed on establishing and maintaining group cohesiveness. This relationship is expressed in the revised (true) mathematical equation: Team + Work (on the Team) = Teamwork.

Derived from text

Project Management; Group Dynamics; Human Reactions; Teams; Activation (Biology)

20020070182 NASA, Washington, DC USA

How I Love My 80 Percenters

Maturo, Anthony J., NASA, USA; ASK Magazine; March 2002, No. 7, pp. 12-16; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Don't ever take your support staff for granted. by support staff, I mean the people in personnel, logistics, and finance; the ones who can make things happen with a phone call or a signature, or by the same token frustrate you to no end by their inaction; these are people you must depend on. I've spent a lot of time thinking about how to cultivate relationships with my support staff that work to the advantage of both of us. The most important thing that have learned working with people, any people--and I will tell you how I learned this in a minute--is there are some folks you just can't motivate, so forget it, don't try; others you certainly can with a little psychology and some effort; and the best of the bunch, what I call the 80 percenters, you don't need to motivate because they're already on the team and performing beautifully. The ones you can't change are rocks. Face up to it, and just kick them out of your way. I have a reputation with the people who don't want to perform or be part of the team. They don't come near me. If someone's a rock, I pick up on it right away, and I will walk around him or her to find someone better. The ones who can be motivated I take time to nurture. I consider them my projects. A lot of times these wannabes are people who want to help but don't know how. Listen, you can work with them. Lots of people in organizations have the mindset that all that matters are the regulations. God forbid if you ever work outside those regulations. They've got one foot on that regulation and they're holding it tight like a baby holds a blanket. What you're looking for is that first sign that their minds are opening. Usually you hear it in their vocabulary. What used to sound like "We can't do that ... the regulations won't allow it ... we have never done this before," well, suddenly that changes to "We have options ... let's take a look at the options ... let me research this and get back to you." The 80 percenters you want to nurture too, but they're already on the team. The 80 percenters know the regulation, but if there is a problem because of a regulation, they will still tell you, "Don't worry about it, I've got it under control." These people don't see themselves as guardians of the regulations. Instead, they see themselves as customer service representatives. Two 80 percenters on my team are Hettie Courtney at Goddard Space Flight Center and Debbie Randall at NASA Headquarters in Code B. Thank you, ladies, very much. You are the best.

Author

Personnel Management; Organizations; Regulations

20020070183 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Keeping the Deal

Hecht, Michael, Jet Propulsion Lab., California Inst. of Tech., USA; ASK Magazine; March 2002, No. 7, pp. 17-21; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

On the 4th of July 1997, I lay on a blanket with my family at a fireworks display near our home in Los Angeles, California. The pyrotechnics, they tell me, were dazzling. I wouldn't know. My attention was fixed on a tiny orange dot in the sky - Mars. A month earlier, NASA had released an Announcement of Opportunity for a supplementary payload on the Mars Surveyor Lander mission scheduled for launch in 2001. The Human Exploration and Development of Space (HEDS) organization had been authorized to make the most preliminary of investigations into the feasibility of sending humans to Mars. Among the requested investigations was an opportunity to study the dust and soil of the Red Planet, emphasizing possible hazards to human explorers. I spent that summer of '97 working on a proposal for the project I would eventually lead, the Mars Environmental Compatibility Assessment (MECA). MECA was selected in February of '98. We promised to deliver four new instruments by April 2000 with a modest budget of \$5M. This is a story about some of the people who created MECA.

Derived from text

Mars Missions; Space Exploration; NASA Space Programs

20020070184 NASA, Washington, DC USA

The Idyllic Workplace

Schoenfelder, Tony E., NASA, USA; ASK Magazine; March 2002, No. 7, pp. 22-26; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

How many of us have worked in organizations where the discipline was so rigid and unyielding that it would send even a Marine Corps Drill Instructor screaming into the night? How many of us have worked in organizations where sightings of senior management were sporadic and rare, and any other interactions were by appointment only? Or, how many of us have worked in organizations where your role, absent specific direction, was to be seldom seen and rarely heard? and how many of us have worked in organizations where seemingly light itself was not permitted to escape without the acquiescence and approval of the director? Sadly, there are organizations that embody some of these conditions, and the resultant adverse effects on employee productivity, creativity and morale are profound. But what if you could work in an organization in which there was little hierarchy, where rank

and seniority played no part, where there were no closed meetings or doors, where everyone knows what was expected of them, and where creativity was not only tolerated but encouraged and celebrated? Was there ever such a place? There was, and it was known as NASA's Space Station Task Force. I was fortunate enough to work there for a time, and I would like to tell you how this organization with few apparent rules led to incredibly high levels of employee satisfaction and fulfillment, and yielded work products of enduring quality. On May 20, 1982, NASA Administrator James M. Beggs established the Space Station Task Force under the direction of John D. Hodge. The Task Force was charged with the responsibility for "the development of the programmatic aspects of a Space Station as they evolve, including mission analysis, requirements definition and program management," and was authorized to draw on Space Station activities at the NASA Program Offices and Field Centers. No additional conditions or directions were provided. Hodge knew that in order to accomplish the job he had been given, he was going to have to obtain the services of the "best and the brightest" and facilitate the unleashing of the full force of their creative capabilities. In order to avoid the stultifying effects of a typical hierarchical organization, he set up a loosely structured, horizontal organization with only one supervisor of record - himself. He populated this organization with detailees from Headquarters, the field Centers and the Jet Propulsion Lab, thereby assuring himself of the political and technical expertise with which to deal with Congress and the bureaucracy, and conduct the required engineering studies and analyses.

Derived from text

Workloads (Psychophysiology); Project Management; Personnel Development

20020070185 NASA Ames Research Center, Moffett Field, CA USA

My Big Wall

Espinosa, Paul S., NASA Ames Research Center, USA; ASK Magazine; March 2002, No. 7, pp. 27-30; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It was June and I was in Yosemite National Park in California, 2,000-feet off the ground. I was climbing El Capitan, a majestic 3,000-foot high, mile-wide granite monolith--one of the most sought after and spectacular rock climbs in the world. After three days of climbing on its sheer face, and having completed the most difficult part of the route, my partner and I were heading down. A thunderstorm lasting all night and into the morning had soaked our tiny perch and all our worldly possessions. We began rappelling down the vertical wall by sliding to the ends of two 50meter ropes tied together and looped through a set of fixed rings bolted into the rock. At the end of the ropes was another rappel station consisting of a set of rings, placed by previous climbers for retreating parties, which we used to anchor ourselves to the rock face. We then pulled the ropes down from the rings above, threaded the ones in front of our noses and started down another rope length. Everything we brought up for our five-day climb to the summit we had to bring back down with us: ropes, climbing gear of every sort, sleeping bags, extra clothes, food, water, and other essentials. All this we either stuffed into a haul bag (an oversized reinforced duffel bag) or slung over our shoulders. The retreat was slow and methodical, akin to a train backing down a mountain, giving me ample time to think. My situation made me think about my work, mostly, about all the projects I have managed, or been involved in managing. As a NASA project manager, I have worked on a number of successful projects. I have also been involved in a number of projects I never saw the end of. I thought about all the projects I transferred off of for other opportunities, projects that were in full stride and ran out of funding, and ones put on the shelf because they would not meet a flight date. Oh yes, I have had many success, to be sure, or I would have burned out years ago. Lessons from both the successful and not-so-successful projects have taught me valuable lessons, but it has always been the failures where I've learned the most.

Derived from text

Human Performance; Physical Work; Project Management

20020070186 Proctor and Gamble Co., Food and Beverage Global Business Unit, USA

The Join-Up Meeting

Cameron, W. Scott, Proctor and Gamble Co., USA; ASK Magazine; March 2002, No. 7, pp. 31-33; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

I recently took on a new assignment and, as is my norm, I scheduled a series of one-hour, 1:1 join-up meetings with the various lead personnel on the team and their hierarchy. During one of these meetings, the person I was meeting with informed me how pleasantly surprised she was that I had scheduled this meeting as very few individuals took the time anymore to have them. I was shocked. I was taught that establishing a 1:1 relationship with the people on your team is critical to the project's success. This was the first time I'd heard anything like this about join-up meetings. I filed this feedback away. Later I was talking to my project manager-mentor, and he indicated he had finished his join-up meetings with every person in his new organization. He also indicated his predecessor had conducted few, if any, join-up meetings. Again, I was shocked. When I reflected on these two experiences, I realized a very negative trend might be emerging in our fast-paced, schedule-driven, 500-e-mail-per-day, cell-phone -ringing, 24/7 -communication, multi-tasking work lives: NO FACE TIME! Face time is what you spend with people

to talk about the project you are working on, their expectations of you, your expectations of them, your hierarchy's expectations about each of you, and/or-last but certainly not least-what each of you plans on achieving during the project. A 1:1, face-to-face, join-up meeting is the only way I know to build solid trust between the project manager and the team members and their hierarchy. Derived from text

Project Management; Organizations; Verbal Communication

20020070187 Air Force Center for Acquisition Excellence, Washington, DC USA

Willpower

Little, Terry, Air Force Center for Acquisition Excellence, USA; ASK Magazine; March 2002, No. 7, pp. 34-35; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

I am struck by how often failure is blamed on a lack of discipline. You often hear losing coaches cite this as the reason for a big loss. I don't recall the last time I heard one say that his team lost a game because of his players' lack of skill. I think a breakdown in discipline is also one of the key reasons why program and project management teams fail to meet expectations. The first program I ever managed had a clear set of priorities. I understood the mandate, and so did everyone else on the team. We set an ambitious schedule and started to work fervently. Not too long into the program the customer wanted to know what performance he was going to get. I replied by categorizing the performance parameters into three bins: 1. Performance you will get. 2. Performance you may get. 3. Performance that there's no way you will get. Did that cause an uproar. The customer demanded everything in the second bin be moved to the first, and most everything in the third bin moved to the second. My immediate impulse was to agree, but I managed to overcome that. In my heart, I knew that we would never meet the already ambitious schedule if we had to deliver more performance. No was my answer. The program turned out to be a huge success, but the result would have been largely different had senior management or I failed to maintain discipline.

Derived from text

Project Management; Human Relations; Human Performance

20020070188 Johns Hopkins Univ., Space Dept., Laurel, MD USA

Hot Meetings

Chiu, Mary, Johns Hopkins Univ., USA; ASK Magazine; March 2002, No. 7, pp. 36-38; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A colleague walked by my office one time as I was conducting a meeting. There were about five or six members of my team present. The colleague, a man who had been with our institution (The Johns Hopkins Applied Physics Lab, a.k.a. APL) for many years, could not help eavesdropping. He said later it sounded like we were having a raucous argument, and he wondered whether he should stand by the door in case things got out of hand and someone threw a punch. Our Advanced Composition Explorer (ACE) team was a hot group, to invoke the language that is fashionable today, although we never thought of ourselves in those terms. It was just our modus operandi. The tenor of the discussion got loud and volatile at times, but I prefer to think of it as animated, robust, or just plain collaborative. Mary Chiu and her "hot" team from the Johns Hopkins Applied Physics Laboratory built the Advanced Composition Explorer spacecraft for NASA. Instruments on the spacecraft continue to collect data that inform us about what's happening on our most important star, the Sun.

Derived from text

Advanced Composition Explorer; NASA Programs; Conferences; Project Management

20020070189 Proctor and Gamble Co., Food and Beverage Global Business Unit, USA

ASK Talks with W. Scott Cameron

Cameron, W. Scott, Proctor and Gamble Co., USA; ASK Magazine; March 2002, No. 7, pp. 39-45; In English; Also announced as 20020070178; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents an interview with Scott Cameron who is the Capital Systems Manager for the Food and Beverage Global Business Unit of Procter and Gamble. He has been managing capital projects and mentoring other project managers for the past 20 years at Procter and Gamble within its Beauty Care, Health Care, Food and Beverage, and Fabric and Home Care Businesses. Scott also has been an Academy Sharing Knowledge (ASK) feature writer since Volume One.

CASI

Project Management; Industrial Management; Commerce

20020070190 NASA, Washington, DC USA

Check Out These Books

Collins, Michelle, Editor, NASA, USA; Mulenburg, Gerald, NASA Ames Research Center, USA; ASK Magazine; March 2002,

No. 7, pp. 46-48; In English; Also announced as 20020070178; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The book entitled "Fusion Leadership: Unlocking the Subtle Forces that Change People and Organizations Richard L. Daft and Robert H. Lengel (1998) Berett-Koehler Publishers, Inc." was Reviewed by Dr. Michelle Collins, NASA Headquarters. If you've already read books on leadership and organizational change by authors such as Moshe Rubinstein and Iris Firstenberg, Peter Senge, Tom Peters, and Steven Covey, and you were thinking of rereading them, you don't have to do that now. Just read this book instead. It's a fusion of many of their same concepts presented from a different view. The book does not explore any particular subject in depth. Rather the authors "skim" many subjects and concepts, interlacing them to develop the concept of "Fusion Leadership". The fundamental concept of treating people as people rather than machines is the main theme. "Fusion Leadership" is the process of fusing people together by nurturing six "subtle" forces: mindfulness, courage, vision, heart, communication, and integrity. to do so, hierarchy is diminished and responsibility both for oneself as well as for the team is emphasized. There are a number of organizations and managers that will find such a change threatening. The concepts behind such a management style are straightforward and the benefits are intuitive once you've reflected on them; however, the obvious benefits of the behavioral change proposed in Fusion Leadership can be completely lost in a fear-based system. The concept of caring about people in one's organization was the common thread in Chris Turner's book All Hat, No Cattle (see book review, ASK 5). Much is being written about the re-humanizing of the workplace, but the basis of it is so common sense that one wonders what's taking so long for the workplace to change? Whether you're in a position to change your organization or simply your project team, you'll find the concepts in fusion leadership equally applicable.

Derived from text

Leadership; Organizations; Handbooks; Project Management

20020070464 Systolics Ltd., Ottawa, Ontario Canada

IRONMAN V 1.5: Network Management Environment

Kuchta, Milan, Systolics Ltd., Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 19-1 - 19-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The recognition of the importance of defensive capabilities against intrusion into enterprise networks has increased over the past decade. Governments around the world have become aware, sometimes dramatically, that their internet-based information and support systems are subject to intrusion and compromise. Within industry, proprietary corporate information is accessible through the intranet-to-internet gateways. Although firewalls, encryption and other existing techniques have provided some protection, they have also provided restrictions on corporate use of the internet resource and have not fully succeeded in preventing intrusions. Numerous excellent commercial and academic efforts have resulted in vulnerability scanning, intrusion detection and network management applications and products. Unfortunately, only a few of these are efficient or scaleable in very large heterogeneous enterprise environments and none provide a comprehensive management environment. IRONMAN is a system which is being developed and used to integrate academic and commercial tools providing network discovery/scanning, intrusion detection and management capabilities. Added to these tools (and enhancements to them) are a data visualization environment, modeling, analysis and reasoning tools, and a policy management framework. It is a prototype environment designed to provide interactive management of networks and network components and services. Interaction is provided through a VRML (Virtual Reality Modeling Language) 2.0 3D (three-dimensional) virtual environment and through additional extended controls such as forms and dialog boxes. VRML 2.0 provides a framework for dynamic visualization of information and systems.

Derived from text

Computer Networks; Information Systems; Computer Information Security; Protection; Scientific Visualization; Network Analysis

20020070465 Missouri Univ., Dept. of Electrical and Computer Engineering, Rolla, MO USA

Identifying Enterprise Intrusion

Miller, A., Missouri Univ., USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 20-1; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper outlines some of the different types of computer network intrusions that can be perpetrated against organizations including: probes, denial of service, reading classified or private files, and destruction of data. There must be a multi-sensor, data fusion approach to identifying such intrusions, and it must be implemented throughout the organization. There are numerous ideas regarding network traffic management and intrusion detection.

CASI

Computer Networks; Network Control; Warning Systems; Computer Information Security

20020070473 NASA, Washington, DC USA

ASK Magazine, No. 8

Post, Todd, Editor, EduTech Ltd., USA; Laufer, Alexander, Editor, NASA, USA; May 2002; 56p; In English; Also announced as 20020070474 through 20020070485; Original contains color illustrations

Report No.(s): NASA/NP-2002-06-291-HQ; NAS 1.83:06-291-HQ; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

During our lives we lose our innocence and gain experience about the world on myriad occasions. What do we learn about ourselves from this? Uncomfortable as such occasions may be when they occur, reflective practitioners will see them later on for what they are: terrific opportunities to learn. Experience may come by way of profound moments of change, or occur over long stretches of time by the steady accrual of small changes. Change doesn't occur any less often as we get older, but a lifetime of dealing with change certainly provides us with precious insights of how to weather our changes better. Essential to being a reflective practitioner is a willingness to test one's assumptions and change what one believes with new knowledge. We find this theme played out in all of the following stories.

Author (revised)

Project Management; Leadership; Learning

20020070474 NASA, Washington, DC USA

Something Special

Hoffman, Edward, NASA, USA; ASK Magazine; May 2002, No. 8, pp. 5-7; In English; Also announced as 20020070473; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There is plenty of interest and excitement in APPL's (Academy of Program and Project Leadership) KS (Knowledge Sharing) effort. We have received numerous requests for members of the KS Team to give presentations about what we're doing. A recent Knowledge Management Roundtable at NASA Headquarters drew record-setting attendance for the event. A few weeks later, I was invited to give a presentation for the Census Bureau. Ron Taylor, a senior leader of the organization, had requested the presentation. I was looking forward to a group of about 20 people or so. As it turned out, the auditorium was packed. Nearly 300 people were in attendance. They were excited about what we're doing and wanted to pick my brain as to how they could establish something like our KS effort in their organization.

Derived from text

Project Management; Information Management

20020070475 NASA, Washington, DC USA

So Much Depends Upon a Pickup Truck

Laufer, Alexander, Editor, NASA, USA; ASK Magazine; May 2002, No. 8, pp. 8; In English; Also announced as 20020070473; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An anecdote from the author's own career as a researcher stresses the importance of becoming thoroughly familiar with a subject under study, in order to avoid overlooking obvious factors. In one study he conducted in Israel, he found that pickup truck size sometimes determined work crew size.

CASI

Operations Research; Project Management

20020070476 NASA Goddard Space Flight Center, Greenbelt, MD USA

Loss and Recovery

Schwer, Ken, NASA Goddard Space Flight Center, USA; ASK Magazine; May 2002, No. 8, pp. 9-12; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The author recounts his experiences of the loss of the QuickTOMS (Total Ozone Mapping Spectrometer) spacecraft, for which he was project manager. He draws from the launch failure lessons on leadership, coping with loss and maintaining morale.

Author

Personnel Management; Failure; Leadership

20020070477 NASA, USA

Boiling Point

Jansen, Michael C., NASA, USA; ASK Magazine; May 2002, No. 8, pp. 13-18; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The author recounts his experiences he helped to investigate the accident which destroyed the Space Shuttle Challenger. The focus was on how he used novel approaches to investigate heat transfer in the shuttle's hydrogen tank, after an expert he sought for advice proved unhelpful.

CASI

Challenger (Orbiter); Space Shuttle Mission 51-L; Failure Analysis

20020070478 NASA Goddard Space Flight Center, Greenbelt, MD USA

When My Name Suddenly Was "Murphy"

Mitchell, David, NASA Goddard Space Flight Center, USA; ASK Magazine; May 2002, No. 8, pp. 19-21; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The author recounts how he was named the Launch Vehicle Manager for the Mars Pathfinder mission, after his project manager suffered a heart attack shortly before launch. He explains that he was prepared for the sudden responsibilities, since his project manager required that he learn many new skills.

CASI

Project Management; Personnel Development

20020070479 NASA Marshall Space Flight Center, Huntsville, AL USA

Less of Me

Owen, Tim, NASA Marshall Space Flight Center, USA; ASK Magazine; May 2002, No. 8, pp. 22-26; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The author warns that micromanagement of projects can provoke defensive attitudes among employees, and inhibits their professional development. Nevertheless, project managers should still demand some accountability from their subordinates. The article draws upon his own experiences as a NASA project manager and under NASA project managers for these lessons.

CASI

Personnel Management; Project Management

20020070480 NASA Ames Research Center, Moffett Field, CA USA

Is There A Perfect Organization?

Schonfeld, Julie, NASA Ames Research Center, USA; ASK Magazine; May 2002, No. 8, pp. 27-32; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A NASA project manager describes her experiences working during a leave of absence at Cisco Systems. She provides an overview of Cisco's corporate culture, particularly the level of attention which its managers paid to the opinions of subordinate employees. She also describes the problems she and other employees had with one manager which caused her to return to NASA.

CASI

Employee Relations; Personnel Management

20020070481 Proctor and Gamble Co., Food and Beverage Global Business Unit, USA

A Big Raise, A Promotion, Or...

Cameron, W. Scott, Proctor and Gamble Co., USA; ASK Magazine; May 2002, No. 8, pp. 33-35; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A project manager reflects on the benefits of assigning awards to employees, versus traditional rewards involving money or competition. He includes an anecdote from his own experience to illustrate how employees appreciate official recognition.

CASI

Employee Relations; Reward (Psychology)

20020070482 Air Force Center for Acquisition Excellence, Washington, DC USA

Three Insights About Change

Little, Terry, Air Force Center for Acquisition Excellence, USA; ASK Magazine; May 2002, No. 8, pp. 36-37; In English; Also announced as 20020070473; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Managers need to develop credibility, and need to base it upon new managerial accomplishments rather than previous ones. New and exciting jobs in management are challenging, but can lead to personal growth. Personnel who are afraid of potential

negative consequences resulting from administrative changes are a hindrance to projects. An approval-seeking management style almost always fails.

CASI

Project Management; Management Planning

20020070483 NASA Goddard Space Flight Center, Greenbelt, MD USA

Continuous Risk Management

Sabelhaus, Phil, NASA Goddard Space Flight Center, USA; ASK Magazine; May 2002, No. 8, pp. 38-39; In English; Also announced as 20020070473; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Risk identification is an ongoing activity that takes place during the routine project work flow. Project activities such as programmatic and technical meetings, telecons, reviews, and other forms of communication often bring to light project risks. When this occurs, we record and analyze the risk on a Risk Information Sheet. This process helps the project team identify and cope with project risks throughout the life of the project.

Author

Risk; Project Management

20020070484 Rothenberg (Joseph), USA

ASK Talks With Joseph Rothenberg

Rothenberg, Joseph, Rothenberg (Joseph), USA; ASK Magazine; May 2002, No. 8, pp. 40-45; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recently retired NASA administrator Joseph Rothenberg reflects on project management during the Apollo era at the start of his career, as well as the history of, and changes in, project management over his years at NASA. He concludes by describing what he sees as NASA's most important needs in the near future.

CASI

Project Management; NASA Programs

20020070485 EduTech Ltd., Silver Spring, MD USA

Conference Report: Masters Forum IV, February 2002

Post, Todd, EduTech Ltd., USA; ASK Magazine; May 2002, pp. 46-50; In English; Also announced as 20020070473; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of the APPL Masters Forum is to bring together some of the best project managers at NASA, as well as those in industry and other government agencies, for 2 1/2 days of knowledge sharing. The project managers come eager to reflect on their project experiences, to learn new things from one another--and to unlearn a few things, too. This was the fourth Masters Forum, and the first one held outside Washington, DC. Fifty participants from across the country came to Dallas at the American Airlines Conference Center, a wonderful facility that was conveniently located by the airport and yet still seemed isolated from the rest of the world. Masters Forum IV was also the first one held during the winter. Previous Masters Forums have been during the summer. Hot, sticky Washington, D.C. in the summer may sound unpleasant, but frankly the popularity of earlier Forums is what led to this annual event becoming a semiannual one.

Derived from text

Conferences; Project Management

20020070558 National Science Foundation, Div. of Science Resources Studies, Washington, DC USA

Methodology Underlying the Measurement of R and D Expenditures: 2000 (data update)

Dec. 10, 2001; 70p; In English

Report No.(s): PB2002-108113; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Research and development (R&D) is defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. Although R&D expenditures have never been more than 3 percent of the USA economy, R&D has been widely recognized as a key ingredient for economic growth. Though its precise effects have been difficult to measure, or sometimes even identify, R&D expenditures continue to be studied by scientific and government communities in efforts to understand and improve the patterns of technological change that occur in the economy and society. Along these lines, the National Science Foundations Division of the Science Resources Statistics (SRS), acquires and publishes data on R&D statistics through its R&D Statistics Program. In doing so, SRS fulfills the legislative mandate of the National Science Foundation Act to provide a central clearinghouse for the

collection, interpretation, and analysis of data on scientific and engineering resources, and to provide a source of information for policy formulation by other agencies of the Federal Government.

NTIS

Research and Development; Methodology; Data Acquisition

20020070650 NASA Glenn Research Center, Cleveland, OH USA

Energy Management Control Systems: Tools for Energy Savings and Environmental Protection

Zsebik, Albin, Budapest Univ. of Technology and Economics, Hungary; Zala, Laszlo F., NASA Glenn Research Center, USA; July 2002; 13p; In English

Contract(s)/Grant(s): RTOP 772-20-02-02

Report No.(s): NASA/TM-2002-211365; E-13187; NAS 1.15:211365; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The change in the price of energy has encouraged the increase of energy efficiency. This report will discuss a tool to promote energy efficiency in intelligent buildings, energy management control systems (EMCS). In addition to the online control of energy production, supply, and consumption, the function of the EMCS is to support short- and long-term planning of the system operation as well as to collect, store, and regularly evaluate operation data. The strategies behind planning and implementing the EMCS as well as the manipulating the resulting data are discussed in this report.

Author

Management Systems; Energy Conservation

20020070667 General Accounting Office, Washington, DC USA

Internal Revenue Service: Status of Recommendations from Financial Audits and Related Financial Management Reports

Jul. 2002; 46p; In English

Report No.(s): PB2002-108356; GAO-02-848; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides a status of the Internal Revenue Service's (IRS) efforts to implement recommendations we have made based on our audits of IRS's financial statements. In updating the status of these recommendations, we have included the results of our audit of IRS's financial statements for fiscal years 2001 and 2000. This report is being provided to you to (1) assist IRS management in tracking the unresolved issues identified in prior GAO financial audits, and (2) report on the current status of open audit recommendations detailed in previous GAO financial audit and financial management related reports. In cases where IRS has taken action on open recommendations that did not result in us closing them, we explain why this occurred. Since our first audit of IRS's financial statements in fiscal year 1992, our audits have identified a number of weaknesses in IRS's financial management operations. In related reports on IRS's internal controls and in management letters, we have recommended corrective action to address those weaknesses. In connection with its efforts to comply with the Federal Managers' Financial Integrity Act (FMFIA) and the Federal Financial Management Improvement Act of 1996 (FFMIA), IRS prepares quarterly remedial action plans to address identified internal control weaknesses. These remedial action plans document IRS's approach to addressing each of the financial management related audit recommendations it receives and includes information on actions already taken to address the issues that gave rise to the recommendation. Appendix I lists (1) recommendations we have made based on our financial audits that we have not previously reported as closed, (2) a synopsis of IRS's planned corrective action and status of each recommendation as reported in its remediation plan as of March 31, 2002, or communicated to us in discussions with management or in IRS's response to our fiscal year 2001 management report, and (3) our analysis of whether the recommendation has been implemented based on the work performed during our fiscal year 2001 financial audit. The table also highlights in bold the nine recommendations which we consider to be of the highest priority to assist senior management in the prioritization of its resources to resolve the most pressing financial management challenges facing IRS.

NTIS

Financial Management; Revenue

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

20020067750 Oklahoma Dept. of Libraries, USA Government Information Div., Oklahoma City, OK USA

Annotated Bibliography of Government Documents Related to the Threat of Terrorism and the Attacks of September 11, 2001

Motes, Kevin D.; Apr. 17, 2002; 99p; In English; Original contains color images

Report No.(s): AD-A403622; No Copyright; Avail: CASI; A05, Hardcopy

The attacks on the World Trade Center in New York and the Pentagon in Washington, DC, came as a terrible surprise to most Americans—from the upper echelons of political power to the streets of small-town America. Though most Americans do not live in New York or Washington, all were deeply affected by the terrorist attacks. and perhaps for the first time in many Americans' lives, the complex web of interconnected political and social threads in which we live came into specific relief. The new world that we now inhabit comes as a sharp contrast to the heady and seemingly more carefree era of the dot-com economic boom, the Oslo accords, and relative peace. Before the attacks occurred, before they were planned, before some of the participants were even born, chains of events leading to the present situation were already in motion. Officials and strategic advisors over the years have predicted that some day events such as the September 11 attacks would occur, and the federal government responded to those predictions by evaluating, planning, and training. As the documents included in this bibliography attest, that work continues, and will continue into the foreseeable future. This bibliography is intended to serve as a means of access to information produced by the USA Government concerning the events of September 11. Unlike so many of the nations of the world, the United States considers fundamental the right of its citizens to know what their government is doing, the logic behind its actions, and the ramifications of its policies. to this end, our government produces copious quantities of informational materials that are freely accessible to the public through libraries and the Federal Depository Library system. This bibliography presents a sampling of the materials available through the Depository system, via the Internet, or both.

DTIC

Bibliographies; Terrorism; Governments; Documents

20020067756 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

Data Fusion and Sensor Management

Benameur, Kaouthar; Dec. 2001; 44p; In English

Report No.(s): AD-A403789; DREO-TR-2001-146; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report addresses the problem of data fusion and sensor management based on a synergistic use of the information provided by multiple sensors. In the first studied case, we deal with the problem of measurement strategy computation for a passive receiver. The basic problem is then to compute an optimal policy, during a specified observation time interval so that a prediction accuracy is optimized. It is shown that the optimal measurement policy can be precomputed before the measurements actually occur. The second case describes research work on the selection of a strategy of measurements for an active and a passive systems. The approach is based on selecting at each instant of time, a set of measurements provided by one or more sensors. Each sensor measurement has an associated cost. The basic problem is then to select an optimal measurement policy, during a specified receding horizon observation interval, so that a weighted combination of prediction accuracy and observation cost is optimized.

DTIC

Multisensor Fusion; Time Measurement; Computation

20020067768 Army Command and General Staff Coll., School of Advanced Military Studies, Fort Leavenworth, KS USA

Terrorist Use of the Internet and Related Information Technologies

Tibbetts, Patrick S.; May 15, 2002; 67p; In English

Report No.(s): AD-A403802; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

How will U.S. national security policy be affected by terrorist exploitation of the Internet and related information technologies? Information operations are nothing new; they have been used in military operations throughout the history of conflict. Arguably, however, the combination of breakneck speed of technological advances in information management systems and evolving threats the U.S. national security are redefining forever the nature of warfare. Some proponents have seen the great promise of information operations as the capability to mitigate, if not eliminate, the fog and friction of war by 'seeing all'. Consequently, current information operations doctrine seems to be focused squarely on the advantages of using leading edge technologies to obtain real-time intelligence, surveillance and reconnaissance, thus creating a 'common operating picture' of a

more or less traditional battlefield. However, as the recent terrorist attacks in New York and Washington illustrate, we will likely continue to face significant threats from elusive, unconventional enemies operating in the shadows of a nontraditional 'battlefield'. Moreover, because of the proliferation of cheap, dual-use information technology, these enemies may possess now, or acquire in the future, the technical expertise and hardware to further their own political agendas, harass and frustrate U.S. attempts to conduct information operations (perhaps even to the extent of negating U.S. information superiority altogether), or directly attack the U.S. infrastructure or population. Information technology has thus given terrorists their own ability to 'see all' on their own traditional battlefield: the populations and civilian infrastructure of the nations they wish to influence or destroy.

DTIC

Information Systems; Internets; Terrorism; Information Management

20020068042 Research and Technology Organization, Neuilly-sur-Seine, France

RTO Technical Publications: A Quarterly Listing *Quarterly Report, 1 Apr. - 30 Jun. 2002*

July 2002; 2p; In English

Report No.(s): RTO-02-02; No Copyright; Avail: Issuing Activity; Abstract Only

This is a listing of recent unclassified RTO (Research and Technical Organization) technical publications processed by the NASA Center for Aerospace Information. Reports may be downloaded for free from the RTO website at <http://www.rta.nato.int> or they may be purchased from the NASA Center for Aerospace Information, 7121 Standard Drive, Hanover, MD 21076-1320 USA, phone 301-621-0390, fax 301-621-0134. Prices and order forms are available from the NASA STI website at <http://www.sti.nasa.gov>. An automatic distribution of unclassified RTO technical publications in CD-ROM is also available within the U.S. through the NASA Standing Order Service from the NASA Center for Aerospace Information.

Author

Information Dissemination; Bibliographies

20020068092 National Security Agency, Central Security Service, Fort Meade, MD USA

National Training Standard for Information Systems Security (INFOSEC) professionals

McConnell, J. M.; Jun. 20, 1994; 30p; In English; Prepared in cooperation with IATAC, Falls Church, VA

Report No.(s): AD-A404113; NSTISSI-4011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This instruction establishes the minimum standard for the training of information systems security (INFOSEC) professionals in the disciplines of telecommunications and automated information systems (AIS) security.

DTIC

Telecommunication; Computer Information Security

20020068093 Corps of Engineers, Washington, DC USA

Engineering and Design: Policies, Guidance, and Requirements for Geospatial Data and Systems

Aug. 01, 1996; 9p; In English

Report No.(s): AD-A404112; USACE-ER-1110-1-8156; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This regulation prescribes the policy for the acquisition, processing, storage, distribution, and utilization of non-tactical geospatial data throughout the U.S. Army Corps of Engineers (USACE) and prescribes policy to comply with Executive Order (EO) 12906, Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure (NSDI). This regulation also provides guidance and requirements and identities standards for Geospatial Data and Systems (GD&S) by complying with this regulation, USACE will maximize its use of GD&S technologies; will promote interoperability among GD&S technologies; will reduce duplication of non-tactical geospatial data collection and software development; will support the digital geospatial data life cycle; and will strengthen the USACE role in the NDI.

DTIC

Geographic Information Systems; Data Acquisition

20020068386 Trinity Coll., Dept. of Computer Science, Dublin, Ireland

Dynamic Reconfiguration of FPGA Nodes In A Distributed Computing System: A Preliminary Investigation *Final Report, 20 Aug. 1999 - 20 Aug 2000*

Nixon, Patrick A.; Dobson, S.; Barron, P.; Apr. 29, 2002; 37p; In English; Original contains color images

Contract(s)/Grant(s): F61775-99-WE072

Report No.(s): AD-A403960; EOARD-SPC-99-4072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Trinity College, Dublin to investigate a specialized portion of a heterogeneous information system, specifically, Field Programmable Gate Array (FPGA)-based nodes. New computing architectures will be

investigated that can specify and dedicate FPGA processing elements (FPE) that take advantage of application/algorithm dependent dataflow. This research will be presented in three interim reports, describing the integration of a FPGA system and a Corba control architecture as detailed in the technical proposal. As well, a final specification, design and evaluation report will be delivered.

DTIC

Data Processing; Information Systems; Heterogeneity; Distributed Processing; Architecture (Computers)

20020068835 Memphis Univ., Dept. of Engineering Technology, Memphis, TN USA

Database Reports Over the Internet

Smith, Dean Lance, Memphis Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLIX-1 - XLIX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Most of the summer was spent developing software that would permit existing test report forms to be printed over the web on a printer that is supported by Adobe Acrobat Reader. The data is stored in a DBMS (Data Base Management System). The client asks for the information from the database using an HTML (Hyper Text Markup Language) form in a web browser. JavaScript is used with the forms to assist the user and verify the integrity of the entered data. Queries to a database are made in SQL (Sequential Query Language), a widely supported standard for making queries to databases. Java servlets, programs written in the Java programming language running under the control of network server software, interrogate the database and complete a PDF form template kept in a file. The completed report is sent to the browser requesting the report. Some errors are sent to the browser in an HTML web page, others are reported to the server. Access to the databases was restricted since the data are being transported to new DBMS software that will run on new hardware. However, the SQL queries were made to Microsoft Access, a DBMS that is available on most PCs (Personal Computers). Access does support the SQL commands that were used, and a database was created with Access that contained typical data for the report forms. Some of the problems and features are discussed below.

Derived from text

Data Base Management Systems; Document Markup Languages; Java (Programming Language); Internets; Electronic Publishing

20020068995 NASA Ames Research Center, Moffett Field, CA USA

Demonstrations at Supercomputing 1998

Bryson, Steve, NASA Ames Research Center, USA; Kenwright, David, MRJ Technology Solutions, Inc., USA; Cox, Michael, MRJ Technology Solutions, Inc., USA; Sterling, Glenn Deardorff, NASA Ames Research Center, USA; Henze, Chris, MRJ Technology Solutions, Inc., USA; Uselton, Sam, MRJ Technology Solutions, Inc., USA; Kao, David, NASA Ames Research Center, USA; Green, Bryan, MRJ Technology Solutions, Inc., USA; [1998]; 2p; In English; Supercomputing 1998, 9-12 Nov. 1998, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 519-40-72; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Contents of the papers include: Visualization techniques- The next generation, Small-machine visualizing very big data sets, Public display of Lunar Prospector data, Steering molecules via Feel, High-dimensional data browser, Multi-source visualization, Interactive surface flow visualization, and the Virtual Windtunnel.

CASI

Supercomputers; Scientific Visualization; Computerized Simulation; Image Processing; Display Devices; Applications Programs (Computers); Conferences

20020070461 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Visualisation of Heterogeneous Military Data in Geographical Information Systems

Kaster, A., Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Germany; Kaster, J., Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Germany; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 16-1 - 16-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

I will focus on the fact that current problems in the use of complex Information Systems are often caused by insufficiencies of the human-machine interface. In order to overcome these problems it is necessary to develop strategies which help to create task and user oriented man machine interfaces that fulfill the requirements specified in ergonomic standards. We believe that

architecture models on the basis of "componentware technology" may help to design systems of high flexibility that can be adapted to actual user needs and task requirements.

Derived from text

Geographic Information Systems; Information Systems; Man Machine Systems; Armed Forces

20020070463 Air Force Research Lab., Rome, NY USA

Data Mining and Concept Clustering in Determining the Nature of a Network Attack

Maciag, Chet, Air Force Research Lab., USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 18-1 - 18-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

Commonly most effort within the Information Assurance (IA) arena has been focused on finding the attack signature but protection, detection and reaction all need to be visualized. As humans and machines are tuned in to see specific patterns there is a need to visualize data/information in different ways to see odd or unusual patterns. The results of one visualization should then be able to be added into another visualization giving the user another chance to gain more understanding from the data. Within network management very little work has been done on the correlation between the cyber and the real world in an operational environment. It is important to do this in order to show the way that the availability of the communications network (both blue and red) could affect the operation. In order to do this the operations communications structure has to be mapped. This includes both the hardware and how networks are connected to each other e.g. via other countries' networks (whether civil or military) for both the blue and red forces. It also needs to highlight the capacity and real structure of the red theatre communication links and how they can be effected. The aim is to fuse IA and network management into a common enterprise picture.

Derived from text

Data Mining; Pattern Recognition; Scientific Visualization; Communication Networks; Defense; Cluster Analysis

20020070466 Air Force Research Lab., Rome, NY USA

Defensive Information Warfare Branch Presentation

Maciag, C., Air Force Research Lab., USA; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 21-1 - 21-2; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The Air Force Research Laboratory's Defensive Information Warfare Branch is focused on discerning new ways of defending information and information systems against attacks from hostile parties. There are three main aspects to this mission: detection, protection, and reaction. Any defensive system should emphasize each of these aspects equally, as they are of equal importance. Visualization techniques are playing an increasingly important role in information systems management and computer information security.

CASI

Information Systems; Armed Forces; Warfare; Military Technology; Computer Information Security

20020070468 QinetiQ Ltd., Malvern, UK

Using Data Compression to Increase the Bandwidth of Existing Tactical Control System: Content Based Compression

Varga, M. J., QinetiQ Ltd., UK; Vant, M., Defence Research Establishment Ottawa, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 23-1 - 23-3; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A01, Hardcopy

The huge investment in military sensors has meant rapid growth in the quality, diversity and quantity of images collected by the variety of military image acquisition systems. This has outpaced existing transmission, storage and retrieval systems. The military requirements for low bandwidth/power, covert operation, high quality transmission for non cooperative imaging and huge data volumes place severe demands on current state-of-the-art technology. At present, effective and timely communication of large imagery is prohibitive. It is slow and it consumes large portions of available communications capacity. Yet the transmission of imagery is becoming an increasingly important and widespread requirement. It is believed that if information cannot be received or delivered in a reasonable time efficiently and effectively then it is pointless to collect it. Images in their raw form contain vast amounts of data within which a smaller amount of information may be relevant to particular applications, e.g. tactical control, surveillance, target recognition, change detection, underwater mine hunting, etc. There is an urgent military need for an intelligent compression approach that will provide an efficient and effective means of transmitting, storing and managing images based on their informative content. This need is apparent across the range of military environments, from beyond line of sight air communications to underwater communications, from intelligence analysis to covert surveillance as well as fixed and deployable command and control systems and tactical control systems. The aim of the presentation was to show the benefits in applying the intelligent image compression technique in military application. The idea is to use image understanding to structure the applied compression so as to ensure that the compression process does not corrupt the militarily important information contained within

the image, while still attaining high compression ratios. The system characteristics correspond to clearly identified military requirements and has been evaluated in this context.

Derived from text

Bandwidth; Imagery; Military Technology; Video Compression; Data Transmission

20020070469 Houston (Ben), Orlean, Ontario Canada

A Simple 3D Visual Text Retrieval Interface

Houston, Ben, Houston (Ben), Canada; Jacobson, Zack, Consulting and Audit Canada, Canada; Multimedia Visualization of Massive Military Datasets; August 2002, pp. 24-1 - 24-6; In English; Also announced as 20020070445; Copyright Waived; Avail: CASI; A02, Hardcopy

3D (three-dimensional) visual text retrieval interfaces are currently a fringe topic of interest. This paper suggests that 3D visual interfaces are fringe topics because of the complexity and abstract nature of many of the previous attempts in this area. In order for 3D visual interfaces to become mainstream this paper proposes that they must be concrete in the metaphor they employ, simple to use, and appear familiar to the average web user. In a set of two prototypes, AutoViz and NetViz, an attempt is made to fulfill these requirements. The prototypes represent the query terms in one plane and the documents in a second parallel plane. A spring system is used to cluster the terms and documents into a meaningful structure. Document profiles are displayed to the user as they move the mouse on top of document representations.

Author

Searching; Information Retrieval; Graphical User Interface

84

LAW, POLITICAL SCIENCE AND SPACE .POLICY

Includes: aviation law; space law and policy; international law; international cooperation; and patent policy

20020070597 Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden

US-Russian Nuclear Weapons Relations: Continuity and Change *Rysk-Amerikanska Kaernvapenrelationer. Foeraendring och Kontinuitet*

Arbman, G.; Danielson, G.; Doerfer, I.; Rydqvist, J.; Stenholm, L.; Sep. 2001; 96p; In Swedish

Report No.(s): PB2002-105008; FOI-R-0113-SE; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In the US-Soviet Cold War strategic balance, the offensive capability widely surpassed the defensive, which was limited by the ABM Treaty. This strategy was appropriately called MAD (Mutual Assured Destruction). In a time of continued proliferation, the USA wants to leave the MAD strategy by diminishing its offensive arsenal while increasing the defensive capability in form of a national missile defense. In addition, the new American strategy comprises non-proliferation efforts. The rationale behind this is that the USA does not want to be a part of any new MAD relationships. Upholding strategic parity with the USA and thereby preserving a great power status is imperative to Russia, which, as Washington, will not accept new MAD relationships vis-a-vis third parties. Political, military-strategic, economic and technical reasons make it very likely that the US and Russia will reach an agreement on the ABM Treaty allowing an American missile defense. Today Russia has at its disposal TMD systems, which are at least as good as the American equivalents. Due to Russian conventional military weakness, tactical nuclear weapons play a more important role for Russia. The Russian tactical nuclear arsenal is larger than the American, whereas the US strategic arsenal outnumbers the Russian. to maintain its nuclear arsenal the USA has diminished its physical infrastructure, relying more on simulations and partial testing. Russia, on the other hand, has maintained a larger physical infrastructure for construction, production and maintenance of its nuclear arsenal. Today the USA contribute substantially to enhance Russian nuclear safety. Among other things, a Moscow-based Joint Early Warning Data Center is in the making. The overall picture of US-Russian nuclear weapons relations is therefore one of both change and continuity.

NTIS

Nuclear Weapons; International Relations; Radiation Protection; Defense Program

TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see 03 Air Transportation and Safety, 16 Space Transportation and Safety, and 44 Energy Production and Conversion. For specific technology transfer applications see also the category where the subject is treated.

20020068965 General Motors Corp., Indianapolis, IN USA

Well-to-Wheel Energy Use and Greenhouse Gas Emissions of Advanced Fuel/Vehicle Systems. North American Analysis. Volume 1. Executive Summary Report

Jun. 2001; 224p; In English

Report No.(s): DE2002-40409; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

There are differing yet strongly held views among the various 'stakeholders' in the advanced fuel/propulsion system debate. In order for the introduction of advanced technology vehicles and their associated fuels to be successful, it seems clear that four important stakeholders must view their introduction as a 'win': Society, Automobile manufacturers and their key suppliers, Fuel providers and their key suppliers, and Auto and energy company customers. If all four of these stakeholders, from their own perspectives, are not positive regarding the need for and value of these advanced fuels/vehicles, the vehicle introductions will fail. This study was conducted to help inform public and private decision makers regarding the impact of the introduction of such advanced fuel/propulsion system pathways from a societal point of view. The study estimates two key performance criteria of advanced fuel/propulsion systems on a total system basis, that is, 'well' (production source of energy) to 'wheel' (vehicle). These criteria are energy use and greenhouse gas emissions per unit of distance traveled. The study focuses on the U.S. light-duty vehicle market in 2005 and beyond, when it is expected that advanced fuels and propulsion systems could begin to be incorporated in a significant percentage of new vehicles. Given the current consumer demand for light trucks, the benchmark vehicle considered in this study is the Chevrolet Silverado full-size pickup.

NTIS

Propulsion System Performance; Propulsion System Configurations; Exhaust Emission; Greenhouse Effect; Exhaust Gases

20020069143 Argonne National Lab., Chemical Technology Div., IL USA

Metal/Ceria Water-Gas Shift Catalysts for Automotive Polymer Electrolyte Fuel Cell Systems

Myers, D. J.; Krebs, J. F.; Carter, J. D.; Kumar, R.; Krumpelt, M.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-41745; No Copyright; Avail: National Technical Information Service (NTIS)

Polymer electrolyte fuel cell (PEFC) systems are a leading candidate for replacing the internal combustion engine in light duty vehicles. One method of generating the hydrogen necessary for the PEFC is reforming a liquid fuel, such as methanol or gasoline, via partial oxidation, steam reforming, or autothermal reforming (a combination of partial oxidation and steam reforming). The H₂-rich reformat can contain as much as 10% carbon monoxide. Carbon monoxide has been shown to poison the platinum-based anode catalyst at concentrations as low as 10 ppm, necessitating removal of CO to this level before passing the reformat to the fuel cell stack.

NTIS

Catalysts; Fuel Cells; Automobile Fuels; Electrolytic Cells

ASTRONOMY

Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20020067738 NASA Goddard Space Flight Center, Greenbelt, MD USA

Probing the Masses of the PSR J0621+1002 Binary System Through Relativistic Apsidal Motion

Spaver, Eric M., Princeton Univ., USA; Nice, David J., Princeton Univ., USA; Arzoumanian, Zaven, NASA Goddard Space Flight Center, USA; Camilo, Fernando, Columbia Univ., USA; Lyne, Andrew G., Manchester Univ., UK; Stairs, Ingrid H., National Radio Astronomy Observatory, USA; [2002]; 32p; In English

Contract(s)/Grant(s): NSF 96-18357; GO1-2063X; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Orbital, spin and astrometric parameters of the millisecond pulsar PSR J0621+1002 have been determined through six years of timing observations at three radio telescopes. The chief result is a measurement of the rate of periastron advance, $\omega = 0$

deg.0116 +/-0 deg.0008/yr. Interpreted as a general relativistic effect, this implies the sum of the pulsar mass, $m(1)$, and the companion mass, $m(2)$, to be $M=m(1)+m(2)=2.81 \pm 0.30$ solar mass. The Keplerian parameters rule out certain combinations of $m(1)$ and $m(2)$, as does the non-detection of Shapiro delay in the pulse arrival times. These constraints, together with the assumption that the companion is a white dwarf, lead to the maximum likelihood values $m(1)=1.69^{(+0.30)}_{(-0.30)}$ solar mass and $m(2)=0.98^{(+0.32)}_{(-0.12)}$ solar mass (68% confidence). The other major finding is that the pulsar experiences dramatic variability in its dispersion measure (DM), with gradients as steep as 0.013 pc/cu cm/yr. A structure function analysis of the DM variations uncovers spatial fluctuations in the interstellar electron density that cannot be fit to a single power law, unlike the Kolmogorov turbulent spectrum that has been seen in the direction of other pulsars. Other results from the timing analysis include the first measurements of the pulsar's proper motion, $\mu=3.5 \pm 0.3$ mas/yr, and of its spin-down rate, $dP/dt=4.7 \times 10^{(-20)}$, which, when corrected for kinematic biases and combined with the pulse period, $P=28.8$ ms, gives a characteristic age of $1.1 \times 10^{(exp 10)}$ yr and a surface magnetic field strength of $1.2 \times 10^{(exp 9)}$ G.

Author

Pulsars; Binary Stars; Stellar Structure

20020067747 NASA Goddard Space Flight Center, Greenbelt, MD USA

SAFIRE: Far-Infrared Imaging Spectroscopy with SOFIA

Benford, Dominic, NASA Goddard Space Flight Center, USA; Moseley, Harvey, NASA Goddard Space Flight Center, USA; Chervenak, Jay, NASA Goddard Space Flight Center, USA; Irwin, Kent, National Inst. of Standards and Technology, USA; Pajot, Francois, Institut d'Astrophysique, France; Shafer, Rick, NASA Goddard Space Flight Center, USA; Staguhr, Johannes, Science Systems and Applications, Inc., USA; Stacey, Gordon, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Astronomical Society Meeting, 2-6 Jun. 2002, Albuquerque, NM, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The SOFIA airborne observatory will provide a high spatial resolution, low background telescope for far-infrared astrophysical investigations. Selected as a PI instrument for SOFIA, SAFIRE is an imaging Fabry-Perot spectrograph covering 145 microns-655microns, with spectral resolving power of approx. 1500 (200 kilometers per second). This resolution is well matched to extragalactic emission lines and yields the greatest sensitivity for line detection. SAFIRE will make important scientific contributions to the study of the powering of ULIRGs and AGN, the role of CII cooling in extragalactic star formation, the evolution of matter in the early Universe, and the energetics of the Galactic center. SAFIRE will employ a two-dimensional pop-up bolometer array to provide background limited imaging spectrometry. Superconducting transition edge bolometers and SQUID amplifiers have been developed for these detectors.

Author

Far Infrared Radiation; Imaging Techniques; Infrared Telescopes; Sofia (Airborne Observatory); Spectroscopy; Astrophysics

20020068102 NASA Marshall Space Flight Center, Huntsville, AL USA

Understanding the Long-Term Spectral Variability of Cygnus X-1 from BATSE and ASM Observations

Zdziarski, Andrzej A., Centrum Astronomiczne, Poland; Poutanen, Juri, Stockholm Observatory, Sweden; Paciesas, William S., Alabama Univ., USA; Wen, Linqing, Massachusetts Inst. of Tech., USA; Apr. 08, 2002; 1p; In English

Report No.(s): astro-ph/0204135-Vol-1; No Copyright; Avail: Issuing Activity; Abstract Only

We present a spectral analysis of observations of Cygnus X-1 by the RXTE/ASM (1.5-12 keV) and CGRO/BATSE (20-300 keV), including about 1200 days of simultaneous data. We find a number of correlations between intensities and hardnesses in different energy bands from 1.5 keV to 300 keV. In the hard (low) spectral state, there is a negative correlation between the ASM 1.5-12 keV flux and the hardness at any energy. In the soft (high) spectral state, the ASM flux is positively correlated with the ASM hardness (as previously reported) but uncorrelated with the BATSE hardness. In both spectral states, the BATSE hardness correlates with the flux above 100 keV, while it shows no correlation with the flux in the 20-100 keV range. At the same time, there is clear correlation between the BATSE fluxes below and above 100 keV. In the hard state, most of the variability can be explained by softening the overall spectrum with a pivot at approximately 50 keV. The observations show that there has to be another, independent variability pattern of lower amplitude where the spectral shape does not change when the luminosity changes. In the soft state, the variability is mostly caused by a variable hard (Comptonized) spectral component of a constant shape superimposed on a constant soft blackbody component. These variability patterns are in agreement with the dependence of the rms variability on the photon energy in the two states. We interpret the observed correlations in terms of theoretical Comptonization models. In the hard state, the variability appears to be driven mostly by changing flux in seed photons Comptonized in a hot thermal plasma cloud with an approximately constant power supply. In the soft state, the variability is consistent with flares of hybrid, thermal/nonthermal, plasma with variable power above a stable cold disk. Also, based on broadband pointed observations simultaneous with those of the ASM and BATSE, we find the intrinsic bolometric luminosity

increases by a factor of approximately 3-4 from the hard state to the soft one, which supports models of the state transition based on a change of the accretion rate.

Author

Compton Effect; Gamma Ray Observatory; Mathematical Models; Spectrum Analysis; Variability; Black Holes (Astronomy); Cygnus Constellation

20020068819 Florida Univ., Dept. of Astronomy, FL USA

Science Outreach at NASA's Marshall Space Flight Center

Lebo, George, Florida Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXIX-1 - XXIX-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

At the end of World War II Duane Deming, an internationally known economist enunciated what later came to be called "Total Quality Management" (TQM). The basic thrust of this economic theory called for companies and governments to identify their customers and to do whatever was necessary to meet their demands and to keep them satisfied. It also called for companies to compete internally. That is, they were to build products that competed with their own so that they were always improving. Unfortunately most U.S. corporations failed to heed this advice. Consequently, the Japanese who actively sought Deming's advice and instituted it in their corporate planning, built an economy that outstripped that of the U.S. for the next three to four decades. Only after U.S. corporations reorganized and fashioned joint ventures which incorporated the tenets of TQM with their Japanese competitors did they start to catch up. Other institutions such as the U.S. government and its agencies and schools face the same problem. While the power of the U.S. government is in no danger of being usurped, its agencies and schools face real problems which can be traced back to not heeding Deming's advice. For example, the public schools are facing real pressure from private schools and home school families because they are not meeting the needs of the general public. Likewise, NASA and other government agencies find themselves shortchanged in funding because they have failed to convince the general public that their missions are important. In an attempt to convince the general public that its science mission is both interesting and important, in 1998 the Science Directorate at NASA's Marshall Space Flight Center (MSFC) instituted a new outreach effort using the interact to reach the general public as well as the students. They have called it 'Science@NASA'.

Author

Education; Total Quality Management; Internets

20020068825 Alabama Univ., Dept. of Computer Science, Huntsville, AL USA

Image Dis-Integration for Improved Plasmasphere Visualization

Newman, Timothy S., Alabama Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXVI-1 - XXXVI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Traditionally, study of the plasmasphere has involved terrestrial observation of local characteristics. Global modeling of the plasmasphere in such an observation regime made use of an ensemble of (sparse) local measurements. Recently, sensors aboard the IMAGE (Imager for Magnetopause-to-Aurora Global Exploration) satellite (in particular, the EUV (Extreme Ultra Violet) Imager) have created the potential for truly global study of the plasmasphere. IMAGE was launched in spring of 2000 in an orbit with apogee altitude 7.2 RE(Earth radii) and perigee altitude 1000 km. IMAGE's EUV sensor allows an external view of the distribution of cold plasma in the plasmasphere to be acquired. EUV is designed to image light emission at 30.4 nanometers, which is the emission wavelength of the He⁺ ion in the presence of solar radiation. He⁺ makes up approximately 15-20% of the plasma in the plasmasphere, thus imaging of He⁺ enables determination of plasma distribution. The EUV instrument provides a 90 deg by 84 deg field of view which is imaged as an equally spaced 150x140 pixel array on a spherical imaging surface. The EUV produces an image approximately every 10 minutes when the sensor is operating. Since EUV images contain line-of-sight integrations of plasma distributions, they do not directly express equatorial plane density (which would enable comparison of observed plasma distributions with predictions from models). Furthermore, the plasma density at any point in three-space is not known. The goal of our work was development of a technique that can enable plasma density to be determined throughout three-space. Our approach to creation of a three-space representation of the plasma distribution involves disintegrating the EUV lines of sight to form a volumetric map of plasma densities.

Derived from text

Plasma Density; Plasmasphere; Cold Plasmas; Mapping

20020068826 Mercer Univ., Electrical and Computer Engineering Dept., Macon, GA USA

Experimental Validation of a Neuro-Fuzzy Approach to Phasing the SIBOA Segmented Mirror Testbed

Olivier, Philip D., Mercer Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XXXVIII-1 - XXXVIII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

NASA is preparing to launch the Next Generation Space Telescope (NGST). This telescope will be larger than the Hubble Space Telescope, be launched on an Atlas missile rather than the Space Shuttle, have a segmented primary mirror, and be placed in a higher orbit. All these differences pose significant challenges. This effort addresses the challenge of aligning the segments of the primary mirror during the initial deployment. The segments need to piston values aligned to within one tenth of a wavelength. The present study considers using a neuro-fuzzy model of the Fraunhofer diffraction theory. The intention of the current study was to experimentally verify the algorithm derived earlier. The experimental study was to be performed on the SIBOA (Systematic Image Based Optical Alignment) test bed. Unfortunately the hardware/software for SIBOA was not ready by the end of the study period. We did succeed in capturing several images of two stacked segments with various relative phases. These images can be used to calibrate the algorithm for future implementation. This effort is a continuation of prior work. The basic effort involves developing a closed loop control algorithm to phase a segmented mirror test bed (SIBOA). The control algorithm is based on a neuro-fuzzy model of SIBOA and incorporates nonlinear observers built from observer banks. This effort involves implementing the algorithm on the SIBOA test bed.

Author

Segmented Mirrors; Alignment; Diffraction; Algorithms

20020068829 Mercer Univ., Dept. of Mathematics and Mechanical Engineering, Macon, GA USA

Labview Implementation of Image Processing and Phasing Control for the SIBOA Segmented Mirror Testbed

Partridge, James D., Mercer Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLII-1 - XLII-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

'NASA is preparing to launch the Next Generation Space Telescope (NGST). This telescope will be larger than the Hubble Space Telescope, be launched on an Atlas missile rather than the Space Shuttle, have a segmented primary mirror, and be placed in a higher orbit. All these differences pose significant challenges.' This effort addresses the challenge of implementing an algorithm for aligning the segments of the primary mirror during the initial deployment that was designed by Philip Olivier and members of SOMTC (Space Optics Manufacturing Technology Center). The implementation was to be performed on the SIBOA (Systematic Image Based Optical Alignment) test bed. Unfortunately, hardware/software aspect concerning SIBOA and an extended time period for algorithm development prevented testing before the end of the study period. Properties of the digital camera were studied and understood, resulting in the current ability of selecting optimal settings regarding saturation. The study was successful in manually capturing several images of two stacked segments with various relative phases. These images can be used to calibrate the algorithm for future implementation. Currently the system is ready for testing.

Author

Segmented Mirrors; Alignment; Image Processing

20020068973 NASA Goddard Space Flight Center, Greenbelt, MD USA

First Flight of ARCADE CMB Instrument

Kogut, A., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Astronomical Society, June 2002, Unknown; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

ARCADE (Absolute Radiometer for Cosmology, Astrophysics, and Diffuse Emission) is a balloon-borne cryogenic instrument to measure the spectrum of the cosmic microwave background radiation at centimeter wavelengths. ARCADE compares the sky to an on-board external blackbody target to measure small differences between the sky spectrum and a known blackbody. The instrument uses a novel open-aperture cryogenic design to minimize sources of systematic error. In particular, there are no windows between the cold (2.7 K) optics and the atmosphere during observations. We discuss the cryogenic performance of ARCADE during its first flight in November 2001.

Author

Balloon-Borne Instruments; Cosmic Microwave Background Radiation; Flight Instruments

20020068975 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Large Sparse Aperture Densified Pupil Hypertelescope Concept for Ground Based Detection of Extra-Solar Earth-Like Planets

Gezari, D., NASA Goddard Space Flight Center, USA; Lyon, R., NASA Goddard Space Flight Center, USA; Woodruff, R., Boeing-SVS, Inc., USA; Labeyrie, A., Observatoire de Haute Provence, France; [2002]; 1p; In English; SPIE Meeting on Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A concept is presented for a large (10 - 30 meter) sparse aperture hyper telescope to image extrasolar earth-like planets from the ground in the presence of atmospheric seeing. The telescope achieves high dynamic range very close to bright stellar sources with good image quality using pupil densification techniques. Active correction of the perturbed wavefront is simplified by using 36 small flat mirrors arranged in a parabolic steerable array structure, eliminating the need for large delay lines and operating at near-infrared (1 - 3 Micron) wavelengths with flats comparable in size to the seeing cells.

Author

Apertures; Dynamic Range; Image Resolution; Extrasolar Planets

20020068980 NASA Goddard Space Flight Center, Greenbelt, MD USA

Probing Galaxy Formation and Evolution with Space Born Sub-Millimeter Telescopes

Dwek, Eli, NASA Goddard Space Flight Center, USA; Arendt, Richard G., NASA Goddard Space Flight Center, USA; Moseley, Harvey, NASA Goddard Space Flight Center, USA; Benford, Dominic, NASA Goddard Space Flight Center, USA; Shafer, Richard, NASA Goddard Space Flight Center, USA; Mather, John, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; SPIE Meeting, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A major unresolved question in cosmology is how the complex system of galaxies we see in the present universe evolved from an almost perfectly smooth beginning. Multiwavelength observations of galaxies have revealed that a significant fraction of their UV-visible starlight is absorbed and reradiated by dust at infrared (IR) and submillimeter wavelengths. The cumulative IR-submm. emission from galaxies since the epoch of recombination, the cosmic IR background, has recently been recorded by the COBE satellite. The COBE observations in combination with recent submm surveys conducted with the SCUBA on the 15 m JCMT have shown that most of the radiation from star formation that has taken place in the early stages of galaxy evolution is reradiated by dust at submm wavelengths. Therefore, submm telescopes offer a unique probe of the early stages of galaxy formation and evolution. This talk will: (1) consider the impact of telescope diameter on the depth of the survey (what redshift can be probed) at different wavelengths; (2) discuss the relative scientific merits of high-resolution narrow-field surveys versus lower resolution deep surveys; and (3) show how both strategies offer complementary information crucial to our understanding of the structure and evolution of galaxies in the universe.

Author

Complex Systems; Galactic Evolution; Galactic Structure; Infrared Radiation; Infrared Spectra

20020068986 Liege Univ., Inst. d'Astrophysique, Belgium

An XMM-Newton Observation of the Lagoon Nebula and the Very Young Open Cluster NGC 6530

Rauw, G., Liege Univ., Belgium; Naze, Y., Liege Univ., Belgium; Gosset, E., Liege Univ., Belgium; Stevens, I. R., Birmingham Univ., UK; Blomme, R., Belgian Royal Observatory, Belgium; Corcoran, M. F., Universities Space Research Association, USA; Pittard, J. M., Leeds Univ., UK; Runacres, M. C., Belgian Royal Observatory, Belgium; [2002]; 12p; In English
Contract(s)/Grant(s): P4/05; P5/36; Proj. 13346/98/NL/VJ(ic); No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the results of an XMM-Newton observation of the Lagoon Nebula (M 8). Our EPIC images of this region reveal a cluster of point sources, most of which have optical counterparts inside the very young open cluster NGC 6530. The bulk of these X-ray sources are probably associated with low and intermediate mass pre-main sequence stars. One of the sources experiences a flare-like increase of its X-ray flux making it the second brightest source in M 8 after the O4 star 9 Sgr. The X-ray spectra of most of the brightest sources can be fitted with thermal plasma models with temperatures of kT approximately a few keV. Only a few of the X-ray selected PMS candidates are known to display H(alpha) emission and were previously classified as classical T Tauri stars. This suggests that most of the X-ray emitting PMS stars in NGC 6530 are weak line T Tauri stars. In addition to 9 Sgr, our EPIC field of view contains also a few early-type stars. The X-ray emission from HD 164816 is found to be typical for an O9.5III-IV star. At least one of the known Herbig Be stars in NGC 6530 (LkH(alpha) 115) exhibits a relatively strong X-ray emission, while most of the main sequence stars of spectral type B1 and later are not detected. We also detect (probably) diffuse

X-ray emission from the Hourglass Region that might reveal a hot bubble blown by the stellar wind of Herschel 36, the ionizing star of the Hourglass Region.

Author

Open Clusters; X Ray Sources; X Ray Astronomy; Pre-Main Sequence Stars; Star Formation; X Ray Spectra

20020069001 NASA Goddard Space Flight Center, Greenbelt, MD USA

Variable Stars In the Unusual, Metal-Rich Globular Cluster

Pritzl, Barton J., Michigan State Univ., USA; Smith, Horace A., Michigan State Univ., USA; Catelan, Marcio, Pontificia Univ. Catolica de Chile, Chile; Sweigart, Allen V., NASA Goddard Space Flight Center, USA; [2002]; 92p; In English

Contract(s)/Grant(s): NRA-99-01-ATP-039; NSF AST-95-28080; NSF AST-99-86943; NGC-6441; NGC-6388; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We have undertaken a search for variable stars in the metal-rich globular cluster NGC 6388 using time-series BV photometry. Twenty-eight new variables were found in this survey, increasing the total number of variables found near NGC 6388 to approx. 57. A significant number of the variables are RR Lyrae (approx. 14), most of which are probable cluster members. The periods of the fundamental mode RR Lyrae are shown to be unusually long compared to metal-rich field stars. The existence of these long period RRab stars suggests that the horizontal branch of NGC 6388 is unusually bright. This implies that the metallicity-luminosity relationship for RR Lyrae stars is not universal if the RR Lyrae in NGC 6388 are indeed metal-rich. We consider the alternative possibility that the stars in NGC 6388 may span a range in [Fe/H]. Four candidate Population II Cepheids were also found. If they are members of the cluster, NGC 6388 would be the most metal-rich globular cluster to contain Population II Cepheids. The mean V magnitude of the RR Lyrae is found to be 16.85 +/- 0.05 resulting in a distance of 9.0 to 10.3 kpc, for a range of assumed values of (M(sub V)) for RR Lyrae. We determine the reddening of the cluster to be $E(B - V) = 0.40 \pm 0.03$ mag, with differential reddening across the face of the cluster. We discuss the difficulty in determining the Oosterhoff classification of NGC 6388 and NGC 6441 due to the unusual nature of their RR Lyrae, and address evolutionary constraints on a recent suggestion that they are of Oosterhoff type II.

Author

Globular Clusters; Metallicity; Photometry; Variable Stars

20020069003 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal and Nonthermal X-ray Emission from the Forward Shock in Tycho's Supernova Remnant

Hwang, Una, NASA Goddard Space Flight Center, USA; Decourchelle, Anne, Commissariat a l'Energie Atomique, France; Holt, Stephen S., College of Engineering, USA; Petre, Robert, NASA Goddard Space Flight Center, USA; 2002; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present Chandra CCD images of Tycho's supernova remnant that delineate its outer shock, seen as a thin, smooth rim along the straight northeastern edge and most of the circular western half. The images also show that the Si and S ejecta are highly clumpy, and have reached the forward shock at numerous locations. Most of the X-ray spectra that we examine along the rim show line emission from Si and S, which in some cases must come from ejecta; the continuum is well represented by either thermal or nonthermal models. In the case that the continuum is assumed to be thermal, the temperatures at the rim are all similar at about 2 keV, and the ionization ages are very low because of the overall weakness of the line emission. Assuming shock velocities inferred from radio and X-ray expansion measurements, these temperatures are substantially below those expected for equilibration of the electron and ion temperatures; electron to mean temperature ratios of approximately less than 0.1 - 0.2 indicate at most modest collisionless heating of the electrons at the shock. The nonthermal contribution to these spectra may be important, however, and may account for as many as half of the counts in the 4-6 keV energy range, based on an extrapolation of the hard X-ray spectrum above 10 keV.

Author

X Ray Spectra; Thermal Emission; Electron Energy; Nonthermal Radiation; Shock Waves; Supernova Remnants

20020069016 NASA Goddard Space Flight Center, Greenbelt, MD USA

Discovery of a Second Millisecond Accreting Pulsar: XTE J1751-305

Markwardt, C. B., NASA Goddard Space Flight Center, USA; Swank, J. H., NASA Goddard Space Flight Center, USA; Strohmayer, T. E., NASA Goddard Space Flight Center, USA; intZand, J. J. M., Utrecht Univ., Netherlands; Marshall, F. E., NASA Goddard Space Flight Center, USA; [2002]; 14p; In English

Report No.(s): astro-ph/0206491-Vol-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the discovery by the RXTE PCA of a second transient accreting millisecond pulsar, XTE J1751-305, during regular monitoring observations of the galactic bulge region. The pulsar has a spin frequency of 435 Hz, making it one of the fastest

pulsars. The pulsations contain the signature of orbital Doppler modulation, which implies an orbital period of 42 minutes, the shortest orbital period of any known radio or X-ray millisecond pulsar. The mass function, $f(\text{sub } x) = (1.278 \pm 0.003) \times 10^{-6}$ solar mass, yields a minimum mass for the companion of between 0.013 and 0.0017 solar mass depending on the mass of the neutron star. No eclipses were detected. A previous X-ray outburst in June, 1998, was discovered in archival All-Sky Monitor data. Assuming mass transfer in this binary system is driven by gravitational radiation, we constrain the orbital inclination to be in the range 30 deg-85 deg and the companion mass to be 0.013-0.035 solar mass. The companion is most likely a heated helium dwarf. We also present results from the Chandra HRC-S observations which provide the best known position of XTE J1751-305.

Author

Pulsars; Binary Stars; X Ray Sources

20020069132 NASA Ames Research Center, Moffett Field, CA USA

Transit Detection with a Distributed Network of Telescopes

Castellano, T., NASA Ames Research Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The discovery since 1995 of more than 80 planets around nearby solar-like stars and the photometric detection of a transit of the planet orbiting HD 209458 (producing a more than 1% drop in brightness that lasts 3 hours) has heralded a new era in astronomy. It has now been demonstrated that small telescopes equipped with sensitive and stable electronic detectors can produce fundamental scientific discoveries regarding the frequency and nature of planets outside the solar system. The modest equipment requirements for the measurement of extrasolar planetary transits are achieved by commercial small aperture telescopes and CCD imagers common among amateur astronomers. With equipment already in hand and armed with target lists, observing techniques and software procedures developed by NASA's Ames Research Center and the University of California at Santa Cruz, non-professional astronomers can contribute significantly to the study of planets around other stars. Statistical analyses of the population of parent stars of the known extrasolar planets indicate that approximately one in ten metal-rich stars should harbor a short-period planet. Given the ten percent chance that a given short-period planet displays transits, we therefore expect that approximately 1% of the most metal rich stars will have a planetary companion detectable by this project. A catalog of 206 highly metal rich nearby F, G and K stars has been compiled, and this catalog will provide a rich source of targets. In addition, main sequence F, G, K and M stars identified to have "transit-like" features in the Hipparcos satellite photometry archive will also be monitored. A commercially available "amateur grade" telescope/CCD/software system acquired late during the 2001 "transit season" for HD 209458 has achieved 0.47% RMS precision for 13 minute time sampling from a suburban backyard under less than ideal observing conditions and a realistic range of airmass values.

Author

Detection; Telescopes; Extrasolar Planets; Solar System; Metallic Stars

20020069136 NASA Ames Research Center, Moffett Field, CA USA

Disentangling Structures in the Cluster of Galaxies Abell 133

Way, Michael J., NASA Ames Research Center, USA; [2002]; 1p; In English; Max-Planck Institut fuer Gravitations Physik, Albert-Einstein Inst. Berlin, Germany, 18 Jun. 2002, Berlin, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

A dynamical analysis of the structure of the cluster of galaxies Abell 133 will be presented using multi-wavelength data combined from multiple space and earth based observations. New and familiar statistical clustering techniques are used in combination in an attempt to gain a fully consistent picture of this interesting nearby cluster of galaxies. The type of analysis presented should be typical of cluster studies in the future, especially those to come from the surveys like the Sloan Digital Sky Survey and the 2DF.

Author

Galactic Clusters; Galactic Structure; Sky Surveys (Astronomy); Galaxies

20020069137 NASA Marshall Space Flight Center, Huntsville, AL USA

The Sunyaev-Zel'dovich Effect Spectrum of Abell 2163

LaRoque, S. J., Chicago Univ., USA; Carlstrom, J. E., Chicago Univ., USA; Reese, E. D., Chicago Univ., USA; Holder, G. P., Chicago Univ., USA; Holzapfel, W. L., California Univ., USA; Joy, M., NASA Marshall Space Flight Center, USA; Grego, L., Harvard-Smithsonian Center for Astrophysics, USA; [2002]; 1p; In English

Report No.(s): astro-ph/0204134-v2; No Copyright; Avail: Issuing Activity; Abstract Only

We present an interferometric measurement of the Sunyaev-Zel'dovich effect (SZE) at 1 cm for the galaxy cluster Abell 2163. We combine this data point with previous measurements at 1.1, 1.4, and 2.1 mm from the SuZIE experiment to construct the most complete SZE spectrum to date. The intensity in four wavelength bands is fit to determine the Compton y -parameter ($y(\text{sub } 0)$) and the peculiar velocity ($v(\text{sub } p)$) for this cluster. Our results are $y(\text{sub } 0) = 3.56^{(+0.41+0.27)}_{(-0.41-0.19)} \times 10^{-5}$

-4) and $v(\text{sub } p) = 410((\text{sup } +1030+460) (\text{sub } -850-440)) \text{ km s}(\text{exp } -1)$ where we list statistical and systematic uncertainties, respectively, at 68% confidence. These results include corrections for contamination by Galactic dust emission. We find less contamination by dust emission than previously reported. The dust emission is distributed over much larger angular scales than the cluster signal and contributes little to the measured signal when the details of the SZE observing strategy are taken into account.

Author

Radio Astronomy; Cosmic Microwave Background Radiation; Galactic Clusters; Astronomical Interferometry; Sunyaev-Zeldovich Effect

20020070203 NASA Ames Research Center, Moffett Field, CA USA

Line Intensity and Position Measurements and Derived Band Parameters of the 31103-00001 C-12 O-16(2) Band and its Two Nearby Hot Bands

Giver, Lawrence P., NASA Ames Research Center, USA; Kshirsagar, Rohidas J., NASA Ames Research Center, USA; Freedman, Richard S., NASA Ames Research Center, USA; Chackerian, Charles, Jr., NASA Ames Research Center, USA; Wattson, Richard B., Utah State Univ., USA; Brown, Linda R., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 1p; In English
Contract(s)/Grant(s): RTOP 344-33-50-43; No Copyright; Avail: Issuing Activity; Abstract Only

A set of CO₂ spectra from 4500 to 4780/cm has been obtained at Ames with 1500 m path length using a Bomem DA8 FTS. This spectral region contains a number of weak bands and minor isotopic bands that have been studied at high resolution in the reflection spectrum of Venus by Mandin. Improved laboratory intensity and position measurements should assist modeling the Venus reflection spectra and improve understanding of Venus' upper atmosphere. Also, the laboratory measurements will assist DND intensity computations of weaker bands that cannot be measured, but which are nevertheless significant absorbers in Venus' hot, deep CO₂, atmosphere. For example, some of the weaker bands that are members of the same polyads as the bands in this presentation lie in the nearby 2.3 microns emission window in Venus' night-side spectrum.

Derived from text

Carbon Dioxide; Isotopes; Spectral Bands; Venus Atmosphere

20020070259 Carnegie Institution of Washington, Pasadena, CA USA

The Mount Wilson and Las Campanas Observations Annual Report, 1983 - 1984

[1984]; 68p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers the activities of Mount Wilson and Las Campanas Observatories during the years 1983-1984. The introduction covers administrative and equipment changes, and subsequent chapters detail research on the following areas: Solar Physics and Solar System Astronomy; Stellar Physics; Astrometry; Interstellar Medium; Globular Clusters; The Galaxy; Galaxies; Clusters of Galaxies; Quasars; Cosmology; Instrumentation; Observing Conditions and Observatory Reports; and Staff Activities.

CASI

Astronomical Observatories; Solar Physics; Solar System; Stellar Physics; Globular Clusters; Galaxies; Galactic Clusters; Quasars

20020070260 Carnegie Institution of Washington, Pasadena, CA USA

Hale Observatories Annual Report, 1977 - 1978

Carnegie Institution Year Book 77; December 1978; 76p; In English; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A description is given of the activities and observations at the Hale Observatories. Topics include: Observing Conditions; Physics of the Sun; Solar System; Stellar Spectroscopy; Interstellar Matter; Pulsars; Globular Clusters; The Galaxy; Galaxies; Clusters of Galaxies; Radio Sources; Quasars and Quasi-Stellar Objects; Observational Cosmology; Theoretical Studies; Instrumentation; and the 100-inch du Pont Telescope.

CASI

Astronomical Observatories; Solar Physics; Stellar Spectra; Galaxies; Quasars

20020070261 Carnegie Institution of Washington, Pasadena, CA USA

The Mount Wilson and Las Campanas Observatories Annual Report, 1981 - 1982

Carnegie Institution of Washington Year Book 81; December 1982; 100p; In English; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

In this report are no less than six major search or survey programs in progress: a systematic search for Virgo cluster members, two major radial velocity surveys of galaxies, two major photometric studies of the Galactic halo, and a quasar search program. In addition, two long-range monitoring programs devoted to investigations in solar physics and stellar activity are in progress. Derived from text

Astronomical Observatories; Milky Way Galaxy; Virgo Galactic Cluster; Quasars; Radial Velocity; Astronomical Photometry; Galactic Halos

20020070500 NASA Goddard Space Flight Center, Greenbelt, MD USA

Gamma Ray Large Area Space Telescope (GLAST) Balloon Flight Engineering Model: Overview

Thompson, D. J., NASA Goddard Space Flight Center, USA; Godfrey, G., Stanford Linear Accelerator Center, USA; Williams, S. M., Stanford Univ., USA; Grove, J. E., Naval Research Lab., USA; Mizuno, T., Hiroshima Univ., Japan; Sadrozinski, H. F.-W., California Univ., USA; Kamae, T., Stanford Linear Accelerator Center, USA; Ampe, J., Naval Research Lab., USA; Briber, Stuart, Independent High School, USA; Dann, James, Saint Ignatius High School, USA; [2001]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Gamma Ray Large Area Space Telescope (GLAST) Large Area Telescope (LAT) is a pair-production high-energy (greater than 20 MeV) gamma-ray telescope being built by an international partnership of astrophysicists and particle physicists for a satellite launch in 2006, designed to study a wide variety of high-energy astrophysical phenomena. As part of the development effort, the collaboration has built a Balloon Flight Engineering Model (BFEM) for flight on a high-altitude scientific balloon. The BFEM is approximately the size of one of the 16 GLAST-LAT towers and contains all the components of the full instrument: plastic scintillator anticoincidence system (ACD), high-Z foil/Si strip pair-conversion tracker (TKR), CsI hodoscopic calorimeter (CAL), triggering and data acquisition electronics (DAQ), commanding system, power distribution, telemetry, real-time data display, and ground data processing system. The principal goal of the balloon flight was to demonstrate the performance of this instrument configuration under conditions similar to those expected in orbit. Results from a balloon flight from Palestine, Texas, on August 4, 2001, show that the BFEM successfully obtained gamma-ray data in this high-background environment.

Author

Balloon Flight; Gamma Ray Telescopes; Flight Tests; Spaceborne Telescopes

20020070663 Liege Univ., Inst. d'Astrophysique et de Geophysique, Belgium

An X-ray Investigation of the NGC 346 Field, 1, The LBV HD 5980 and the NGC 346 Cluster

Naze, Y., Liege Univ., Belgium; Hartwell, J. M., Birmingham Univ., UK; Stevens, I. R., Birmingham Univ., UK; Corcoran, M. F., Universities Space Research Association, USA; Chu, Y.-H., Illinois Univ., USA; Koenigsberger, G., Universidad Nacional Autonoma de Mexico, Mexico; Moffat, A. F. J., Montreal Univ., Canada; Niemela, V. S., Universidad Nacional de la Plata, Argentina; [2002]; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present results from a Chandra observation of the NGC 346 star formation region, which contains numerous massive stars, and is related to N66, the largest H(II) region of the SMC (Small Magellanic Cloud). In this first paper, we will focus on the characteristics of the main objects of the field. The NGC 346 cluster itself shows only relatively faint X-ray emission (with $L((\text{sub X})(\text{sup unabs}))$ is approximately $1.5 \times 10^{34} \text{ erg s}^{-1}$), tightly correlated with the core of the cluster. In the field also lies HD 5980, a LBV (Luminous Blue Variable) star in a binary (or triple system) that is detected for the first time at X-ray energies. The star is X-ray bright, with an unabsorbed luminosity of $L((\text{sub X})(\text{sup unabs}))$ is approximately $1.7 \times 10^{34} \text{ erg s}^{-1}$, but needs to be monitored further to investigate its X-ray variability over a complete orbital cycle. The high X-ray luminosity may be associated either with colliding winds in the binary system or with the 1994 eruption. HD 5980 is surrounded by a region of diffuse X-ray emission, which may be a superimposed supernova remnant.

Author

X Ray Astronomy; X Ray Astrophysics Facility; Blue Stars; Stellar Luminosity; Star Clusters

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20020067730 NASA Ames Research Center, Moffett Field, CA USA

Modelling the Diversity of Outer Planetary Systems

Lissauer, Jack J., NASA Ames Research Center, USA; Levison, H. F., Southwest Research Inst., USA; Duncan, M. J., Queens

Univ., Canada; [1998]; 1p; In English; Division of Planetary Sciences of the American Astronomical Meeting, 11-16 Oct. 1998, Madison, WI, USA; Sponsored by American Astronautical Society, USA

Contract(s)/Grant(s): RTOP 344-30-50-01; Copyright; Avail: Issuing Activity; Abstract Only

The process of planetary growth is extremely complicated, involving a myriad of physical and chemical processes, many of which are poorly understood. The ultimate configuration that a planetary system attains depends upon the properties of the disk out of which it grew, of the star at the center of the disk and, at least in some cases, of the interstellar environment. In an effort to numerically survey the possible diversity of planetary systems, we have constructed synthetic systems of giant planets and integrated their orbits to determine the dynamical lifetimes and thus the viability of these systems. Our construction algorithm begins with 110 -- 180 planetesimals located between 4 and 40 AU from a one solar mass star; most initial planetesimals have masses several tenths that of Earth. We integrate the orbits of these bodies subject to mutual gravitational perturbations and -as drag for $10(\exp 6)$ - $10(\exp 7)$ years, merging any pair of planetesimals which pass within one-tenth of a Hill Sphere of one another and adding "gas" to embryos larger than 10 Earth masses. Use of such large planetesimal radii provided sufficient damping to prevent the system from excessive dynamical heating. Subsequently, systems were evolved without gas drag, either with the enlarged radii or with more realistic radii. Systems took from a few million years to greater than ten billion years to become stable ($10(\exp 9)$ years without mergers or ejections). Some of the systems produced with the enlarged radii closely resemble our outer Solar System. Many systems contained only Uranus-mass objects. Encounters in simulations using realistic radii resulted in ejections, typically leaving only a few planets per system, most of which were on very eccentric orbits. Some of the systems that we constructed were stable for at least a billion years despite undergoing macroscopic orbital changes on much shorter timescales.

Author

Planetary Systems; Protoplanets; Gas Giant Planets; Chemical Reactions; Stellar Mass

20020067736 NASA Marshall Space Flight Center, Huntsville, AL USA

The Anisotropy of the Microwave Background to $l = 3500$: Deep Field Observations with the Cosmic Background Imager

Mason, B. S., Owens Valley Radio Observatory, USA; Pearson, T. J., Owens Valley Radio Observatory, USA; Readhead, A. C. S., Owens Valley Radio Observatory, USA; Shepherd, M. C., Owens Valley Radio Observatory, USA; Sievers, J., Owens Valley Radio Observatory, USA; Udomprasert, P. S., Owens Valley Radio Observatory, USA; Cartwright, J. K., Owens Valley Radio Observatory, USA; Farmer, A. J., Owens Valley Radio Observatory, USA; Padin, S., Owens Valley Radio Observatory, USA; Myers, S. T., National Radio Astronomy Observatory, USA; [2002]; 2p; In English

Report No.(s): astro-ph/0205384-Vol-1; No Copyright; Avail: Issuing Activity; Abstract Only

We report measurements of anisotropy in the cosmic microwave background radiation over the multipole range l approximately 200 (right arrow) 3500 with the Cosmic Background Imager based on deep observations of three fields. These results confirm the drop in power with increasing l first reported in earlier measurements with this instrument, and extend the observations of this decline in power out to l approximately 2000. The decline in power is consistent with the predicted damping of primary anisotropies. At larger multipoles, $l = 2000$ -3500, the power is 3.1 sigma greater than standard models for intrinsic microwave background anisotropy in this multipole range, and 3.5 sigma greater than zero. This excess power is not consistent with expected levels of residual radio source contamination but, for sigma 8 is approximately greater than 1, is consistent with predicted levels due to a secondary Sunyaev-Zeldovich anisotropy. Further observations are necessary to confirm the level of this excess and, if confirmed, determine its origin.

Author

Anisotropy; Background Radiation; Cosmic Microwave Background Radiation; Microwaves; Radio Astronomy

20020067741 NASA Goddard Space Flight Center, Greenbelt, MD USA

X-Ray Properties of Lyman Break Galaxies in the Hubble Deep Field North Region

Nandra, K., Universities Space Research Association, USA; Mushotzky, R. F., NASA Goddard Space Flight Center, USA; Arnaud, K., Maryland Univ., USA; Steidel, C. C., California Inst. of Tech., USA; Adelberger, K. L., Harvard-Smithsonian Center for Astrophysics, USA; Gardner, J. P., NASA Goddard Space Flight Center, USA; Teplitz, H. I., Catholic Univ. of America, USA; Windhorst, R. A., Arizona State Univ., USA; [2002]; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the X-ray properties of a large sample of z approximately 3 Lyman Break Galaxies (LBGs) in the region of the Hubble Deep Field North, derived from the 1 Ms public Chandra observation. of our sample of 148 LBGs, four are detected individually. This immediately gives a measure of the bright AGN (active galactic nuclei) fraction in these galaxies of approximately 3 per cent, which is in agreement with that derived from the UV (ultraviolet) spectra. The X-ray color of the detected sources indicates that they are probably moderately obscured. Stacking of the remainder shows a significant detection (6 sigma) with an average luminosity of $3.5 \times 10(\exp 41)$ erg/s per galaxy in the rest frame 2-10 keV band. We have also studied

a comparison sample of 95 z approximately 1 "Balmer Break" galaxies. Eight of these are detected directly, with at least two clear AGN based on their high X-ray luminosity and very hard X-ray spectra respectively. The remainder are of relatively low luminosity (is less than 10^{42} erg/s, and the X-rays could arise from either AGN or rapid star-formation. The X-ray colors and evidence from other wavebands favor the latter interpretation. Excluding the clear AGN, we deduce a mean X-ray luminosity of 6.6×10^{40} erg/s, a factor approximately 5 lower than the LBGs. The average ratio of the UV and X-ray luminosities of these star forming galaxies $L(\text{sub UV})/L(\text{sub X})$, however, is approximately the same at $z = 1$ as it is at $z = 3$. This scaling implies that the X-ray emission follows the current star formation rate, as measured by the UV luminosity. We use our results to constrain the star formation rate at z approximately 3 from an X-ray perspective. Assuming the locally established correlation between X-ray and far-IR (infrared) luminosity, the average inferred star formation rate in each Lyman break galaxy is found to be approximately 60 solar mass/yr, in excellent agreement with the extinction-corrected UV estimates. This provides an external check on the UV estimates of the star formation rates, and on the use of X-ray luminosities to infer these rates in rapidly starforming galaxies at high redshift.

Author

X Ray Spectra; Cosmic X Rays; Star Formation Rate; Active Galactic Nuclei; Luminosity; Active Galaxies

20020067742 NASA Goddard Space Flight Center, Greenbelt, MD USA

Future Experiments in Astrophysics

Krizmanic, John F., Universities Space Research Association, USA; [2002]; 14p; In English; 10th International Conference on Calorimetry in High Energy Physics, 25-29 Mar. 2002, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The measurement methodologies of astrophysics experiments reflect the enormous variation of the astrophysical radiation itself. The diverse nature of the astrophysical radiation, e.g. cosmic rays, electromagnetic radiation, and neutrinos, is further complicated by the enormous span in energy, from the 1.95 Kappa relic neutrino background to cosmic rays with energy greater than 10^{20} eV. The measurement of gravity waves and search for dark matter constituents are also of astrophysical interest. Thus, the experimental techniques employed to determine the energy of the incident particles are strongly dependent upon the specific particles and energy range to be measured. This paper summarizes some of the calorimetric methodologies and measurements planned by future astrophysics experiments. A focus will be placed on the measurement of higher energy astrophysical radiation. Specifically, future cosmic ray, gamma ray, and neutrino experiments will be discussed.

Author

Calorimeters; Astrophysics; Experiment Design; Measurement

20020067743 NASA Goddard Space Flight Center, Greenbelt, MD USA

Gravitationally Redshifted Absorption Lines in the Burst Spectra of the Neutron Star in the X-Ray Binary EXO 0748-676

Cottoam, J., NASA Goddard Space Flight Center, USA; Paerels, F., Columbia Univ., USA; Mendez, M., Space Research Organization Netherlands, Netherlands; [2002]; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The most straightforward manner of determining masses and radii of neutron stars is by measuring the gravitational redshift of spectral lines produced in the neutron star photosphere; such a measurement would provide direct constraints on the mass-to-radius ratio of the neutron star, and therefore on the equation of state for neutron star matter. Using data taken with the Reflection Grating Spectrometer on board the XMM-Newton observatory we identify, for the first time, significant absorption lines in the spectra of 28 bursts of the low-mass X-ray binary EXO 0748-676. The most significant features are consistent with the Fe XXVI and XXV $n=2-3$ and O VIII $n=1-2$ transitions, with a redshift of $z=0.35$, identical within small uncertainties for the different transitions. This constitutes the first direct and unambiguous measurement of the gravitational redshift in a neutron star.

Author

Neutron Stars; Absorption Spectra; Line Spectra; Bursts; Red Shift

20020067777 NASA Marshall Space Flight Center, Huntsville, AL USA

An Introduction to High-Energy Astrophysics: Detectors, Techniques and Missions

Fishman, Gerald J., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; High Energy Astrophysics Workshop for Amateur Astronomers, 29 Jun. - 7 Jul. 2002, Waikoloa Beach, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A series of lectures will be given to acquaint the amateur astronomer with historical, present and future methods of observation in high-energy astrophysics. These will begin with the basic principles of how photons of high energy are detected

and their energy measured. The detectors and data distribution methods will be described. Finally, a comprehensive description of the experiments and missions in high-energy astrophysics will be reviewed.

Author

Astrophysics; Detection; Space Missions; Aerospace Sciences

20020067788 NASA Marshall Space Flight Center, Huntsville, AL USA

XTE J1946+274 = GRO J1944+26: An Enigmatic Be/X-ray Binary

Wilson, Colleen A., NASA Marshall Space Flight Center, USA; Finger, Mark H., Universities Space Research Association, USA; Coe, M. J., Southampton Univ., UK; Negueruela, Ignacio, Observatoire de Strasbourg, France; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

XTE J1946+274 = GRO J1944+26 is a 15.8-s Be/X-ray pulsar discovered simultaneously in 1998 September with the, Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (CGRO) and the All-Sky Monitor (ASM) on the Rossi X-ray Timing Explorer (RXTE). Pulse timing analysis yielded an orbital period of 169.2 days, a moderate eccentricity of 0.33, and implied a mass function of 9.7 solar mass. We observed evidence for an accretion disk, a correlation between measured spin-up rate and flux, which was fitted to obtain a distance estimate of 9.2 ± 1.0 kpc. XTE J1946+274 remained active from 1998 September - 2001 July, undergoing 13 outbursts that were not locked in orbital phase. Comparing RXTE PCA observations from the initial bright outburst in 1998 and the last pair of outburst in 2001, we found energy and intensity dependent pulse profile variations in both outbursts and hardening spectra with increasing intensity during the fainter 2001 outbursts. In 2001 July, optical H(α) observations indicate a density perturbation appeared in the Be disk as the X-ray outbursts ceased. We propose that the equatorial plane of the Be star is inclined with respect to the orbital plane in this system and that this inclination may produce the unusual outburst behavior of the system.

Author

B Stars; Gamma Ray Bursts; Pulsars; Stellar Mass; Visual Observation; X Ray Binaries

20020067791 NASA Goddard Space Flight Center, Greenbelt, MD USA

Interstellar Deuterium, Nitrogen and Oxygen Towards HZ43A: Results from the Far Ultraviolet Spectroscopic Explorer (FUSE) Mission

Kruk, J. W., Johns Hopkins Univ., USA; Howk, J. C., Johns Hopkins Univ., USA; Andre, M., Johns Hopkins Univ., USA; Moos, H. W., Johns Hopkins Univ., USA; Oegerle, William R., NASA Goddard Space Flight Center, USA; Oliveira, C., NASA Goddard Space Flight Center, USA; Sembach, K. R., NASA Goddard Space Flight Center, USA; Chayer, P., NASA Goddard Space Flight Center, USA; Linsky, J. L., Colorado Univ., USA; Wood, B. E., Colorado Univ., USA; [2002]; 68p; In English
Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We present an analysis of interstellar absorption along the line of sight to the nearby white dwarf star HZ43A. The distance to this star is 68 ± 13 pc, and the line of sight extends toward the north Galactic pole. Column densities of O(I), N(I), and N(II) were derived from spectra obtained by the Far Ultraviolet Spectroscopic Explorer (FUSE), the column density of D(I) was derived from a combination of our FUSE spectra and an archival HST GARDENS spectrum, and the column density of H(I) was derived from a combination of the GARDENS spectrum and values derived from EUVE data obtained from the literature. We find the following abundance ratios (with 2 sigma uncertainties): $D(I)/H(I) = (1.66 \pm 0.28) \times 10^{-5}$, $O(I)/H(I) = (3.63 \pm 0.84) \times 10^{-4}$, and $N(I)/H(I) = (3.80 \pm 0.74) \times 10^{-5}$. The N(II) column density was slightly greater than that of N(I), indicating that ionization corrections are important when deriving nitrogen abundances. Other interstellar species detected along the line of sight were C(II), C(III), O(VI), Si(II), Ar(I), Mg(II) and Fe(II); an upper limit was determined for N(III). No elements other than H(I) were detected in the stellar photosphere.

Author

Absorption Spectra; Atmospheric Composition; Interstellar Gas; Far UV Spectroscopic Explorer; Deuterium; Nitrogen; Oxygen

20020068134 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Orbit and Position of the X-ray Pulsar XTE J1855-026: An Eclipsing Supergiant System

Corbet, Robin H. D., NASA Goddard Space Flight Center, USA; Mukai, Koji, NASA Goddard Space Flight Center, USA; [2002]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A pulse timing orbit has been obtained for the X-ray binary XTEJ1855-026 using observations made with the Proportional Counter Array on board the Rossi X-ray Timing Explorer. The mass function obtained of approximately 16 solar mass together with the detection of an extended near-total eclipse confirm that the primary star is supergiant as predicted. The orbital eccentricity is found to be very low with a best fit value of 0.04 ± 0.02 . The orbital period is also refined to be 6.0724 ± 0.0009 days using an improved and extended light curve obtained with RXTE's All Sky Monitor. Observations with the ASCA satellite provide an

improved source location of R.A.= 18 hr 55 min 31.3 sec, decl.= -02 deg 36 min 24.0 sec (2000) with an estimated systematic uncertainty of less than 12 min. A serendipitous new source, AX J1855.4-0232, was also discovered during the ASCA observations.

Author

Supergiant Stars; X Ray Binaries; Eclipsing Binary Stars

20020068547 NASA Goddard Space Flight Center, Greenbelt, MD USA

Deuterium Abundance Toward G191-B2B: Results from the Far Ultraviolet Spectroscopic Explorer (FUSE) Mission

Lemoine, M., Institut d'Astrophysique, France; Vidal-Madjar, A., Institut d'Astrophysique, France; Hebrard, G., Institut d'Astrophysique, France; Desert, J.-M., Institut d'Astrophysique, France; Ferlet, R., Institut d'Astrophysique, France; LecavelierdesEtangs, A., Institut d'Astrophysique, France; Howk, J. C., Johns Hopkins Univ., USA; Andre, M., Johns Hopkins Univ., USA; Blair, W. P., Johns Hopkins Univ., USA; Friedman, S. D., Johns Hopkins Univ., USA; [2002]; 40p; In English
Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-resolution spectra of the hot white dwarf G191-B2B covering the wavelength region 905-1187 Å were obtained with the Far Ultraviolet Spectroscopic Explorer (FUSE). This data was used in conjunction with existing high-resolution Hubble Space Telescope STIS observations to evaluate the total H(sub I), D(sub I), O(sub I) and N(sub I) column densities along the line of sight. Previous determinations of N(D(sub I)) based upon GHRS (Goddard High Resolution Spectrograph) and STIS (Space Telescope Imaging Spectrograph) observations were controversial due to the saturated strength of the D(sub I) Lyman alpha line. In the present analysis the column density of D(sub I) has been measured using only the unsaturated Lyman beta and Lyman gamma lines observed by FUSE. A careful inspection of possible systematic uncertainties tied to the modeling of the stellar continuum or to the uncertainties in the FUSE instrumental character series has been performed. The column densities derived are: $\log N(\text{D(sub I)}) = 13.40 \pm 0.07$, $\log N(\text{O(sub I)}) = 14.86 \pm 0.07$, and $\log N(\text{N(sub I)}) = 13.87 \pm 0.07$ quoted with 2sigma, uncertainties. The measurement of the H(sub I) column density by profile fitting of the Lyman alpha line has been found to be unsecure. If additional weak hot interstellar components are added to the three detected clouds along the line of sight, the H(sub I) column density can be reduced quite significantly, even though the signal-to-noise ratio and spectral resolution at Lyman alpha are excellent. The new estimate of N(H(sub I)) toward G191-B2B reads: $\log N(\text{H(sub I)}) = 18.18 \pm 0.18$ (2sigma uncertainty), so that the average (D/H) ratio on the line of sight is: $(\text{D}/\text{H}) = 1.66 (+0.9/-0.6) \times 10^{-5}$ (2sigma uncertainty).

Author

Deuterium; Ultraviolet Astronomy; Ultraviolet Spectroscopy; Far Ultraviolet Radiation

20020068979 NASA Goddard Space Flight Center, Greenbelt, MD USA

Interstellar Deuterium, Nitrogen and Oxygen Abundances Toward BD+28(deg) 4211: Results from the Far Ultraviolet Spectroscopic Explorer

Sonneborn, George, NASA Goddard Space Flight Center, USA; Andre, Martial, Johns Hopkins Univ., USA; Oliveira, Cristina, Johns Hopkins Univ., USA; Hebrard, Guillaume, Institut d'Astrophysique, France; Howk, J. Christopher, Johns Hopkins Univ., USA; Tripp, Todd M., Princeton Univ. Observatory, USA; Chayer, Pierre, Johns Hopkins Univ., USA; Friedman, Scott D., Johns Hopkins Univ., USA; Kruk, Jeffery W., Johns Hopkins Univ., USA; Jenkins, Edward B., Princeton Univ. Observatory, USA; [2002]; 34p; In English

Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High resolution far-ultraviolet spectra of the O-type subdwarf BD+28(deg)4211 were obtained with the Far Ultraviolet Spectroscopic Explorer to measure the interstellar deuterium, nitrogen, and oxygen abundances in this direction. The interstellar D(I) transitions are analyzed down to Ly(ioat) at 920.7 Å. The star was observed several times at different target offsets in the direction of spectral dispersion. The aligned and coadded spectra have high signal-to-noise ratios (S/N=50-100). D(I), N(I), and O(I) transitions were analyzed with curve-of-growth and profile fitting techniques. A model of interstellar molecular hydrogen on the line of sight was derived from H(II) lines in the FUSE spectra and used to help analyze some features where blending with H(II) was significant. The H(I) column density was determined from high resolution HST/STIS spectra of Ly(alpha) to be $\log N(\text{H(I)}) = 19.846 \pm 0.035$ (2sigma), which is higher than is typical for sight lines in the local ISM studied for D/H. We found that $\text{D}/\text{H} = (1.39 \pm 0.21) \times 10^{-5}$ (2sigma) and $\text{O}/\text{H} = (2.37 \pm 0.55) \times 10^{-4}$ (2sigma). O/H toward BD+28(deg)4211 appears to be significantly below the mean O/H ratio for the ISM and the Local Bubble.

Author

Far UV Spectroscopic Explorer; Deuterium; Nitrogen; Hydrogen; Abundance; Interstellar Gas

20020068985 NASA Goddard Space Flight Center, Greenbelt, MD USA

Migration of Trans-Neptunian Objects to a Near-Earth Space

Ipatov, S. I., NASA Goddard Space Flight Center, USA; Mather, J. C., NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; The New Horizons PKB Mission, 20-21 May 2002, Boulder, CO, USA

Contract(s)/Grant(s): NAG5-10776; INTAS-00-240; RFBR-01-02-17540; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Our estimates of the migration of trans-Neptunian objects (TNOs) to a near-Earth space are based on the results of investigations of orbital evolution of TNOs and Jupiter-crossing objects (JCOs). The orbital evolution of TNOs was considered in many papers. Recently we investigated the evolution for intervals of at least 5-10 Myr of 2500 JCOs under the gravitational influence of all planets, except for Mercury and Pluto (without dissipative factors). In the first series we considered $N=2000$ orbits near the orbits of 30 real Jupiter-family comets with period $P(\text{sub } \alpha) < 10$ yr, and in the second series we took $N=500$ orbits close to the orbit of Comet 10P Tempel 2 ($\alpha=3.1$ AU, $e=0.53$, $i=12$ deg). We calculated the probabilities of collisions of objects with the terrestrial planets, using orbital elements obtained with a step equal to 500 yr, and then summarized the results for all time intervals and all bodies, obtaining the total probability $P(\text{sub } \sigma)$ of collisions with a planet and the total time interval $T(\text{sub } \sigma)$ during which perihelion distance q of bodies was less than a semimajor axis of the planet.

Author

Solar Orbits; Near Earth Objects; Cometary Collisions; Planetary Gravitation; Mathematical Models; Numerical Analysis; Orbital Elements

20020069005 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Matter-Antimatter Asymmetry of the Universe

Stecker, F. W., NASA Goddard Space Flight Center, USA; [2002]; 10p; In English; XIVth Recontres de Blois 2002 on Matter-Antimatter Asymmetry, Jun. 2002, Blois, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

I will give here an overview of the present observational and theoretical situation regarding the question of the matter-antimatter asymmetry of the universe and the related question of the existence of antimatter on a cosmological scale. I will also give a simple discussion of the role of CP (charge conjugation parity) violation in this subject.

Author

Antimatter; Asymmetry; Cp Violation

20020069006 NASA Goddard Space Flight Center, Greenbelt, MD USA

Implications of Ultrahigh Energy Air Showers for Physics and Astrophysics

Stecker, F. W., NASA Goddard Space Flight Center, USA; [2002]; 28p; In English; 7th Paris Cosmology Colloquium on High Energy Astrophysics for and from Space, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary ultrahigh energy particles which produce giant extensive air showers in the Earth atmosphere present an intriguing mystery from two points of view: (1) How are the base particles produced with such astounding energies, eight orders of magnitude higher than those produced by the best man-made terrestrial accelerators? (2) Since they are most likely extragalactic in origin, how do they reach us from extragalactic distances without suffering the severe losses expected from interactions with the 2.7 K thermal cosmic background photons, the so called GZK effect? The answers to these questions may involve new physics: violations of special relativity, grand unification theories, and quantum gravity theories involving large extra dimensions. They may involve new astrophysical sources, "zevatrons". Or some heretofore totally unknown physics or astrophysics may hold the answer. I will discuss here the mysteries involving the production and extragalactic propagation of ultrahigh energy cosmic rays and some suggested possible solutions.

Author

Cosmic Ray Showers; Earth Atmosphere; Astrophysics; Active Galactic Nuclei; Gamma Ray Bursts; Grand Unified Theory

20020069130 Colorado Univ., Boulder, CO USA

The Fundamental Physical Processes Producing and Controlling Stellar Coronal/Transition Region/Chromospheric Activity and Structure Final Report, 1995-2000

Ayres, T. R., Colorado Univ., USA; Brown, A., Colorado Univ., USA; [2000]; 2p; In English

Contract(s)/Grant(s): NAG5-3226; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Our LTSA (Long Term Space Astrophysics) research has utilized current NASA and ESA spacecraft, supporting ground-based IR, radio, and sub-mm telescopes, and the extensive archives of HST (Hubble Space Telescope), IUE (International Ultraviolet Explorer), ROSAT, EUVE (Extreme Ultraviolet Explorer), and other missions. Our research effort has included observational work (with a nonnegligible groundbased component), specialized processing techniques for imaging and spectral

data, and semiempirical modelling, ranging from optically thin emission measure studies to simulations of optically thick resonance lines. In our previous LTSA efforts, we have had a number of major successes, including most recently: organizing and carrying out an extensive cool star UV survey in HST cycle eight; obtaining observing time with new instruments, such as Chandra and XMM (X-ray Multi-Mirror) in their first cycles; collaborating with the Chandra GTO program and participating with the Chandra Emission Line Project on multi-wavelength observations of HR 1099 and Capella. These are the main broad-brush themes of our previous investigation: a) Where do Coronae Occur in the Hertzsprung-Russell Diagram? b) Winds of Coronal and Noncoronal Stars; c) Activity, Age, Rotation Relations; d) Atmospheric Inhomogeneities; e) Heating Mechanisms, Subcoronal Flows, and Flares; f) Development of Analysis and Modelling Tools.

Author (revised)

Stellar Coronas; Ultraviolet Astronomy; X Ray Astronomy; Stellar Activity; Stellar Winds

20020069139 NASA Marshall Space Flight Center, Huntsville, AL USA

Determining the Cosmic Distance Scale from Interferometric Measurements of the Sunyaev-Zel'Dovich Effect

Reese, Erik D., Chicago Univ., USA; Carlstrom, John E., Chicago Univ., USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; Mohr, Joseph J., Illinois Univ., USA; Grego, Laura, Harvard-Smithsonian Center for Astrophysics, USA; Holzappel, William L., California Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The distances to eighteen galaxy clusters are determined, with redshifts ranging from $z \approx 0.14$ to $z \approx 0.78$ from a maximum likelihood joint analysis of 30 GHz interferometric Sunyaev-Zel'dovich effect (SZE) and X-ray observations. We model the intracluster medium (ICM) using a spherical isothermal beta model. We quantify the statistical and systematic uncertainties inherent to these direct distance measurements, and we determine constraints on the Hubble parameter for three different cosmologies. These distances imply a Hubble constant of $60^{(+13)}_{(-18)} \text{ km s}^{-1} \text{ Mpc}^{-1}$ for an $\Omega_M = 0.3$, $\Omega_\Lambda = 0.7$ cosmology, where the uncertainties correspond to statistical followed by systematic at 68% confidence. With a sample of eighteen clusters, systematic uncertainties clearly dominate. The systematics are observationally approachable and will be addressed in the coming years through the current generation of X-ray satellites (Chandra & XMM-Newton) and radio observatories (OVRO (Owens Valley Radio Observatory), BIMA (Berkeley Illinois Maryland Association), & VLA (Very Large Array)). Analysis of high redshift clusters detected in future SZE and X-ray surveys will allow a determination of the geometry of the universe from SZE determined distances.

Author

Radio Astronomy; X Ray Astronomy; Cosmology; Astronomical Interferometry; Sunyaev-Zeldovich Effect

20020070381 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Case for General Relativistic Effects in the Fe K(alpha) Profile of an Active Galaxy

Turner, T. J., Maryland Univ. Baltimore County, USA; Mushotzky, R., NASA Goddard Space Flight Center, USA; Yaqoob, T., Maryland Univ. Baltimore County, USA; George, I. M., Maryland Univ. Baltimore County, USA; Snowden, S. L., NASA Goddard Space Flight Center, USA; Netzer, H., Tel-Aviv Univ., Ramat-Aviv, Israel; Kraemer, S. B., NASA Goddard Space Flight Center, USA; Nandra, K., NASA Goddard Space Flight Center, USA; Chelouche, D., Tel-Aviv Univ., Ramat-Aviv, Israel; [2002]; 24p; In English; Sponsored in part by the Israel National Science Foundation

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We present results from a simultaneous Chandra HETG (High Energy Transmission Grating) and XMM (X-ray Multi-mirror Mission)-Newton observation of NGC 3516. We find evidence for several narrow components of Fe K(alpha) along with a broad line. We consider the possibility that the lines arise in a blob of material ejected from the nucleus with velocity of approximately $0.25c$. We also consider an origin in a neutral accretion disk, suffering enhanced illumination at 35 and 175 $R_{\text{sub g}}$, perhaps due to magnetic reconnection. The presence of these narrow features indicates there is no Comptonizing region along the line-of-sight to the nucleus. This in turn is compelling support for the hypothesis that broad Fe K(alpha) components are, in general, produced by strong gravity.

Author

Relativistic Effects; Active Galaxies; Emission Spectra; X Ray Astronomy

LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

20020069133 NASA Ames Research Center, Moffett Field, CA USA

Enantiomeric and Isotopic Analysis of Sugar Derivatives in Carbonaceous Meteorites

Cooper, George, NASA Ames Research Center, USA; Asiyu, Cynthia, NASA Ames Research Center, USA; Turk, Kendra, NASA Ames Research Center, USA; Jun. 07, 2002; 2p; In English; International Society for the Study of the Origins of Life, 30 Jun. - 4 Jul. 2002, Oaxaca, Mexico

Contract(s)/Grant(s): RTOP 344-38-12-15; No Copyright; Avail: Issuing Activity; Abstract Only

Several classes of organic compounds are found in carbonaceous meteorites including amino acids, carboxylic acids, hydroxy acids, purines, and pyrimidines. Such compounds are thought to have been delivered to the early Earth in asteroids and comets and may have played a role in the origin of life. Likewise, sugar derivatives are critical to all known lifeforms. Recent analyses of the Murchison and Murray carbonaceous meteorites revealed a diverse suite of such derivatives, i.e., sugar alcohols, and sugar acids. This presentation will focus primarily on the analysis of individual sugar acids - their enantiomeric and isotopic composition. Analysis of these compounds may reveal the nature of past (or present) meteoritic sugars themselves. For example, if parent sugars decomposed (by well-known mechanisms) to give the present acids, were their enantiomeric ratios preserved? Combined with other evidence, the enantiomeric composition of such compounds as glyceric acid and (especially) rare acids may help to answer such questions. C-13 and D isotope analysis of meteoritic sugar alcohols (glycerol, threitol, ribitol, etc.) as a group revealed that they were indigenous to the meteorite. Preliminary C-13 analysis of glyceric acid shows that it is also extraterrestrial.

Author

Carbon 13; Carbonaceous Meteorites; Organic Compounds; Sugars; Isotope Ratios; Enantiomers

20020069134 NASA Ames Research Center, Moffett Field, CA USA

Planetary Rings: An Update on Structure and Properties

Cuzzi, Jeff, NASA Ames Research Center, USA; [2002]; 1p; In English; EuroJove Meeting, Lisbon, Lisbon, Portugal, Portugal

Contract(s)/Grant(s): RTOP 344-30-51-02; No Copyright; Avail: Issuing Activity; Abstract Only

Over the last several years there has been steady progress in several areas related to the structure and composition of planetary rings. Much of the progress was related to Saturn's rings: new observations by Hubble Space Telescope (HST) and NASA's Infrared Telescope Facility (IRTF), theoretical modeling of the vertical structure of, and particle properties in the rings, discovery of intriguing structural/spectral variations on small spatial scales, new observations and analysis of thermal emission from the rings, theoretical and observational constraints on the quadrupole brightness asymmetry at visual and microwave wavelengths, and new studies of "clumps" in and near the F ring. In addition, new observations were obtained of Jupiter's rings by Cassini, and new models were put forth to explain the narrow edges and apse alignment of the Uranian rings (and presumably other narrow eccentric rings).

Author

Mathematical Models; Planetary Rings; Planetary Structure; Spaceborne Astronomy

20020070284 NASA Ames Research Center, Moffett Field, CA USA

Fractal Particles: Titan's Thermal Structure and IR Opacity

McKay, C. P., NASA Ames Research Center, USA; Rannou, P., Paris Univ., France; Guez, L., NASA Ames Research Center, USA; Young, E. F., Southwest Research Inst., USA; [1998]; 1p; In English; American Astronomical Society Division of Planetary Sciences Annual Meeting, 11-15 Oct. 1998, Madison, WI, USA; Sponsored by American Astronomical Society, USA

Contract(s)/Grant(s): RTOP 344-33-10-38; Copyright; Avail: Issuing Activity; Abstract Only

Titan's haze particles are the principle opacity at solar wavelengths. Most past work in modeling these particles has assumed spherical particles. However, observational evidence strongly favors fractal shapes for the haze particles. We consider the implications of fractal particles for the thermal structure and near infrared opacity of Titan's atmosphere. We find that assuming fractal particles with the optical properties based on laboratory tholin material and with a production rate that allows for a match to the geometric albedo results in warmer troposphere and surface temperatures compared to spherical particles. In the near infrared (1-3 microns) the predicted opacity of the fractal particles is up to a factor of two less than for spherical particles. This has implications for the ability of Cassini to image Titan's surface at 1 micron.

Author

Haze; Opacity; Satellite Atmospheres; Titan; Atmospheric Optics; Particles

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

20020067735 NASA Marshall Space Flight Center, Huntsville, AL USA

Supergranule Rotation Rates and Lifetimes

Hathaway, David H., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 200th Meeting of the American Astronomical Society, 2-6 Jun. 2002, Albuquerque, NM, Albuquerque, NM, USA, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Previous measurements of the rotation rate of the supergranule Doppler pattern have revealed three interesting characteristics. 1) The supergranule pattern rotates faster than the plasma at the surface and, at each latitude, it rotates faster than the plasma at any level below the surface. 2) Larger cells rotate more rapidly than smaller cells. 3) Faster rotation rates are found when using larger time lags between Doppler images. These last two characteristics are consistent with the idea that large cells live longer and extend deeper into the Sun where the rotation rate is faster. A re-examination of the rotation rates and lifetimes of the Doppler patterns seen with the Michelson Doppler Imager (MDI) instrument on Solar and Heliospheric Observatory (SOHO) confirms these characteristics. However, a simulation of the data using a spectrum for the cellular flows that matches the observed spectrum shows that these characteristics can be largely reproduced by cellular patterns that rotate at the same rate without any dependence upon cell size. The rotation rate, and its dependence on latitude, is nonetheless still faster than the surface or internal rotation rate. The difference in rotation rates as functions of cell size and time lag between observations is attributed to projection effects on the line-of-sight Doppler signal. This data simulation is also used to determine characteristic lifetimes for the cellular patterns as a function of cell size. These lifetime determinations are also affected by projection effects on the line-of-sight Doppler signal.

Author

Rotation; SOHO Mission; Data Simulation; Radio Astronomy

20020067740 Science Applications International Corp., San Diego, CA USA

The Structure and Dynamics of the Solar Corona and Inner Heliosphere Progress Report, 15 May - 15 Aug. 2001

Mikic, Zoran, Science Applications International Corp., USA; Aug. 15, 2002; 66p; In English

Contract(s)/Grant(s): NAS5-99188

Report No.(s): SAIC-01/8013; APPAT-280; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers technical progress during the fourth quarter of the second year of NASA Sun-Earth Connections Theory Program (SECTP) contract "The Structure and Dynamics of the Solar Corona and Inner Heliosphere," NAS5-99188, between NASA and Science Applications International Corporation (SAIC), and covers the period May 16, 2001 to August 15, 2001. Under this contract SAIC and the University of California, Irvine (UCI) have conducted research into theoretical modeling of active regions, the solar corona, and the inner heliosphere, using the MHD (magnetohydrodynamic) model.

Author

Solar Corona; Magnetohydrodynamics; Heliosphere; Mathematical Models

20020068005 NASA Goddard Space Flight Center, Greenbelt, MD USA

The EUV Helium Spectrum in the Quiet Sun: A By-Product of Coronal Emission?

Andretta, Vincenzo, Osservatorio Astronomico, Capodimonte, Italy; DelZanna, Giulio, Cambridge Univ., UK; Jordan, Stuart D., NASA Goddard Space Flight Center, USA; [2002]; 16p; In English

Contract(s)/Grant(s): NCC5-377; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we test one of the mechanisms proposed to explain the intensities and other observed properties of the solar helium spectrum, and in particular of its Extreme-Ultraviolet (EUV) resonance lines. The so-called Photoionisation-Recombination (P-R) mechanism involves photoionisation of helium atoms and ions by EUV coronal radiation, followed by recombination cascades. We present calibrated measurements of EUV flux obtained with the two CDS spectrometers on board SOHO, in quiescent solar regions. We were able to obtain an essentially complete estimate of the total photoionizing flux in the wavelength range below 504 Å (the photoionisation threshold for He(I)), as well as simultaneous measurements with the same instruments of the intensities of the strongest EUV helium lines: He(II) λ 304, He(I) λ 584, and He(I) λ 537. We find that there are not enough EUV photons to account for the observed helium line intensities. More specifically, we conclude that He(II) intensities cannot be explained by the P-R mechanism. Our results, however, leave open the possibility

that the He(I) spectrum could be formed by the P-R mechanism, with the He(II) $\lambda 304$ line as a significant photoionizing source.

Author

Solar Corona; Chromosphere; Extreme Ultraviolet Radiation; Line Spectra; Resonance Lines; Helium; Radiative Transfer; Radiative Recombination

20020068959 Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

MO and DA on the SWIE Instrument on the Wind Spacecraft Final Report

Lazarus, Alan J., Massachusetts Inst. of Tech., USA; [2002]; 8p; In English

Contract(s)/Grant(s): NAG5-7359

Report No.(s): OSP-6701100; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The construction of the Faraday Cup portion of the SWIE instrument on the Wind spacecraft, participation in Mission Operations, and Data Analysis (MO and DA) of observations of the solar wind has been supported by a sequence of grants. This 'final' Report represents work done on Mission Operations and Data Analysis for the Faraday Cup portion of the SWE. The work reported here was supported under NASA Grant NAG5-7359 (OSP 6701100) from June 1998 to October 2001. It should be noted that this work is continuing under NASA Grant NAG-10915, and therefore this report is 'final' only in the sense that the Grant has changed its number; a future report will cover the entire period of work. We have two types of obligations under these contracts: (1) to provide and assure the validity of "Key Parameters" which describe the basic properties of the solar wind on a daily basis. We have provided our 92 second observations daily via plots and parameters available from our Web site: <http://web.mit.edu/space/www/wind/wind.html> (2). to carry out scientific studies based on our observations. to document the extent of our research, we are including below a list of publications and presentations related to this project. The observations from Wind have made a major contribution to the study of the solar wind, and have every indication of continuing to do so.

Author

Solar Wind; Wind/Ggs Spacecraft; Numerical Analysis; Documents

20020068996 Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

Scientific Analysis of Data for the ISTEP/SOLARMAX Programs Final Report, 15 Jan. 1999 - Aug. 2000

Lazarus, Alan J., Massachusetts Inst. of Tech., USA; [2001]; 2p; In English

Contract(s)/Grant(s): NAG5-8045

Report No.(s): OSP-6804400; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This Grant supplemented our work on data analysis from the Wind spacecraft which was one of the ISTRIA fleet of spacecraft. It was targeted at observations related to the time of solar maximum in 2000. The work we proposed to do under this grant included comparison of solar wind parameters obtained from different spacecraft in order to establish correlation lengths appropriate to the solar wind and also to compare parameters to explore solar cycle effects.

Author

Solar Wind; Statistical Analysis

20020069117 NASA Goddard Space Flight Center, Greenbelt, MD USA

Solar Cycle Variations and Equatorial Oscillations: Modeling Study

Mayr, H. G., NASA Goddard Space Flight Center, USA; Mengel, J. G., Science Systems and Applications, Inc., USA; Drob, D. P., Naval Research Lab., USA; Chan, K. L., University of Science and Technology, China; Porter, H. S., Furman Univ., USA; October 2001; 36p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solar cycle activity effects (SCAE) in the lower and middle atmosphere, reported in several studies, are difficult to explain on the basis of the small changes in solar radiation that accompany the 11-year cycle. It is therefore natural to speculate that dynamical processes may come into play to produce a leverage. Such a leverage may be provided by the Quasi-Biennial Oscillation (QBO) in the zonal circulation of the stratosphere, which has been linked to solar activity variations. Driven primarily by wave mean flow interaction, the QBO period and its amplitude are variable but are also strongly influenced by the seasonal cycle in the solar radiation. This influence extends to low altitudes referred to as "downward control". Relatively small changes in solar radiative forcing can produce small changes in the period and phase of the QBO, but this in turn can produce measurable differences in the wind field. Thus, the QBO may be an amplifier of solar activity variations and a natural conduit of these variations to lower altitudes. to test this hypothesis, we conducted experiments with a 2D (two-dimensional) version of our Numerical Spectral Model that incorporates Hines' Doppler Spread Parameterization for small-scale gravity waves (GW). Solar cycle radiance variations (SCRV) are accounted for by changing the radiative heating rate on a logarithmic scale from 0.1 % at the surface to 1 % at 50 km to 10% at 100 km. With and without SCR, but with the same GW flux, we then conduct numerical

experiments to evaluate the magnitude of the SCAE in the zonal circulation. The numerical results indicate that, under certain conditions, the SCAE is significant and can extend to lower altitudes where the SCRv is inconsequential. At 20-km the differences in the modeled wind velocities are as large as 5 m/s. For a modeled QBO period of 30 months, we find that the seasonal cycle in the solar forcing (through the Semi-annual Oscillation (SAO)) acts as a strong pacemaker to lockup the phase and period of the QBO. The SCAE then shows up primarily as a distinct but relatively weak amplitude modulation. But with the QBO period between 30 and 34 (or less than 30, presumably) months, the seasonal phase lock is weak. Solar flux radiance variations in the seasonal cycle then cause variations in the QBO period and phase that amplify the SCAE to produce relatively large variations in the wind field. These variations also extend to mid latitudes.

Author

Lower Atmosphere; Middle Atmosphere; Quasi-Biennial Oscillation; Solar Activity; Solar Cycles; Atmospheric Effects

20020069138 NASA Marshall Space Flight Center, Huntsville, AL USA

Solar Wind Characteristics from SOHO-Sun-Ulysses Quadrature Observations

Poletto, Giannina, Osservatorio di Firenze, Italy; Suess, Steve T., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Solar Wind 10 Conference, 19 Jun. 2002, Pisa, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Over the past few years, we have been running SOHO (Solar and Heliospheric Observatory)-Sun-Ulysses quadrature campaigns, aimed at comparing the plasma properties at coronal altitudes with plasma properties at interplanetary distances. Coronal plasma has been observed by SOHO experiments: mainly, we used LASCO (Large Angle and Spectrometric Coronagraph Experiment) data to understand the overall coronal configuration at the time of quadratures and analyzed SUMER (Solar Ultraviolet Measurements of Emitted Radiation), CDS (Coronal Diagnostic Spectrometer) and UVCS (Ultraviolet Coronagraph Spectrometer) data to derive its physical characteristics. At interplanetary distances, SWICS (Solar Wind Ion Composition Spectrometer) and SWOOPS (Solar Wind Observation over the Poles of the Sun) aboard Ulysses provided us with interplanetary plasma data. Here we report on results from some of the campaigns. We notice that, depending on the geometry of the quadrature, i.e. on whether the radial to Ulysses traverses the corona at high or low latitudes, we are able to study different kinds of solar wind. In particular, a comparison between low-latitude and high-latitude wind, allowed us to provide evidence for differences in the acceleration of polar, fast plasma and equatorial, slow plasma: the latter occurring at higher levels and through a more extended region than fast wind. These properties are shared by both the proton and heavy ions outflows. Quadrature observations may provide useful information also on coronal vs. in situ elemental composition. To this end, we analyzed spectra taken in the corona, at altitudes ranging between approx. 1.02 and 2.2 solar radii, and derived the abundances of a number of ions, including oxygen and iron. Values of the O/Fe ratio, at coronal levels, have been compared with measurements of this ratio made by SWICS at interplanetary distances. Our results are compared with previous findings and predictions from modeling efforts.

Author

Ultraviolet Astronomy; Sun; Solar Wind; Coronas; Astronomical Spectroscopy; Ultraviolet Spectroscopy

20020069141 NASA Marshall Space Flight Center, Huntsville, AL USA

Relation Between Polar Plumes and Fine Structure in the Solar Wind from Ulysses High-Latitude Observations

Yamauchi, Yohei, NASA Marshall Space Flight Center, USA; Suess, Steven T., NASA Marshall Space Flight Center, USA; Sakurai, Takashi, National Astronomical Observatory, Japan; [2002]; 1p; In English; Solar Wind 10 Conference, 19 Jun. 2002, Pisa, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Ulysses observations showed that pressure balance structures (PBSs) are a common feature in the high-latitude and high-speed solar winds near the solar minimum. On the other hand, coronal plumes are common in polar coronal holes. PBSs are believed to be remnants of coronal plumes and to be related to network activity such as magnetic reconnection in the photosphere from previous studies. This suggests that information on the magnetic structure of PBSs would help to confirm the relation between PBSs and polar plumes. We have investigated the magnetic structures of the PBSs by applying a minimum variance analysis to Ulysses/Magnetometer data and by examining the pitch-angle distribution of energetic electrons measured with Ulysses/SWOOPS. We have found that PBSs have relatively more tangential discontinuities rather than rotational from the minimum variance analysis. Further, most PBSs also show bi-directional electron flux or isotropic pitch-angle distribution or the distribution expected in association with current-sheet structures from the analysis of high-energy electron data. In this, we find further evidence that PBSs are generated due by network activity at the base of polar plumes and their magnetic structures are like current sheets or plasmoids.

Author

Solar Wind; Solar Activity Effects; Coronas; Magnetic Fields; Flux (Rate); Magnetic Poles

20020069148 NASA Goddard Space Flight Center, Greenbelt, MD USA

Angular Distributions of Fe/O From Wind: New Insight Into SEP Transport

Reames, D. V., NASA Goddard Space Flight Center, USA; Ng, C. K., NASA Goddard Space Flight Center, USA; [2002]; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We examine the angular distributions of He, O, and Fe in large solar energetic particle (SEP) events measured on the Wind spacecraft. We report for the first time, that in a fixed velocity interval, Fe/O is often larger for particles flowing sunward along the magnetic field than for particles flowing outward from the Sun in many SEP events. This occurs because the anisotropy for O exceeds that for Fe, even though both species are streaming outward. There are no examples of events for which the outward Fe/O dominates. The behavior of Fe and O conflicts with the expectations of simple diffusion theory, that angular distributions should be independent of species. It also seems to conflict with the idea that energetic Fe scatters less than O of the same velocity. However, preliminary modeling suggests that the presence of a reflecting magnetic boundary beyond 1 AU, together with the increased scattering of O over Fe due to proton generated Alfvén waves, can explain the direction and magnitude of the effect. These observations add a new dimension to the study of SEP transport.

Author

Angular Distribution; Anisotropy; Diffusion Theory; Solar Corpuscular Radiation; Wind/Ggs Spacecraft; Particle Emission; Sun

20020070664 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spatial Relationship of Signatures of Interplanetary Coronal Mass Ejections

Richardson, I. G., NASA Goddard Space Flight Center, USA; Cane, H. V., NASA Goddard Space Flight Center, USA; Lepri, S. T., Michigan Univ., USA; Zurbuchen, T. H., Michigan Univ., USA; Gosling, J. T., Los Alamos National Lab., USA; July 2002; 4p; In English; Solar Wind 10, Jun. 2002, Pisa, Italy

Contract(s)/Grant(s): NCC5-609; Copyright; Avail: Issuing Activity

Interplanetary coronal mass ejections (ICMEs) are characterized by a number of signatures. In particular, we examine the relationship between Fe charge states and other signatures during ICMEs in solar cycle 23. Though enhanced Fe charge states characterize many ICMEs, average charge states vary from event to event, are more likely to be enhanced in faster or flare-related ICMEs, and do not appear to depend on whether the ICME is a magnetic cloud.

Author

Coronal Mass Ejection; Interplanetary Medium; Spatial Distribution; Signatures

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.

20020067785 NASA Marshall Space Flight Center, Huntsville, AL USA

The Soft X-Ray Emission in a Large Sample of Galaxy Clusters with ROSAT PSPC

Bonamente, Massimiliano, Alabama Univ., USA; Lieu, Richard, Alabama Univ., USA; Joy, Marshall K., NASA Marshall Space Flight Center, USA; Nevalainen, Jukka H., Alabama Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The study of soft X-ray emission of 38 X-ray selected galaxy clusters observed by ROSAT PSPC indicates that the soft excess phenomenon may be a common occurrence in galaxy clusters. Excess soft X-ray radiation, above the contribution from the hot intra-cluster medium, is evident in a large fraction of sources, and is clearly detected with large statistical significance in the deepest observations. The investigation relies on new, high resolution 21 cm HI observations. The sample selection also features analysis of infrared images, to further ensure reliability of results with respect to the characteristics of Galactic absorption. The possibility of background or calibration effects as cause of the excess emission is likewise investigated; a detailed analysis of the distribution of the excess emission with respect to detector position and Galactic HI column density shows that the excess emission is a genuine celestial phenomenon. We find evidence for a preferential distribution of the soft excess emission at distances larger than approx. 150-200 kpc from the centers of clusters; this behavior may be naturally explained in the context of a non-thermal Inverse-Compton scenario. Alternatively, we propose that the phenomenon maybe caused by thermal emission of very large-scale 'warm' filaments seen in recent hydrodynamic simulations. This new interpretation relieves the very demanding requirements

of either the traditional intra-cluster 'warm' gas and the non-thermal scenarios. We also investigate the possibility of the soft excess originating from unresolved, X-ray faint cluster galaxies.

Author

ROSAT Mission; Astrophysics; X Ray Astronomy; Emission; Galactic Clusters

20020068003 NASA Marshall Space Flight Center, Huntsville, AL USA

The Anisotropy of the Microwave Background to $l=3500$: Mosaic Observations with the Cosmic Background Imager

Pearson, T. J., California Inst. of Tech., USA; Mason, B. S., California Inst. of Tech., USA; Readhead, A. C. S., California Inst. of Tech., USA; Shepherd, M. C., California Inst. of Tech., USA; Sievers, J. L., California Inst. of Tech., USA; Udomprasert, P. S., California Inst. of Tech., USA; Cartwright, J. K., California Inst. of Tech., USA; Farmer, A. J., California Inst. of Tech., USA; Padin, S., California Inst. of Tech., USA; Myers, S. T., National Radio Astronomy Observatory, USA; May 23, 2002; 2p; In English

Report No.(s): astro-ph/0205388-Vol-1; No Copyright; Avail: Issuing Activity; Abstract Only

Using the Cosmic Background Imager, a 13-element interferometer array operating in the 26-36 GHz frequency band, we have observed 40 deg (sup 2) of sky in three pairs of fields, each approximately 145 feet x 165 feet, using overlapping pointings: (mosaicing). We present images and power spectra of the cosmic microwave background radiation in these mosaic fields. We remove ground radiation and other low-level contaminating signals by differencing matched observations of the fields in each pair. The primary foreground contamination is due to point sources (radio galaxies and quasars). We have subtracted the strongest sources from the data using higher-resolution measurements, and we have projected out the response to other sources of known position in the power-spectrum analysis. The images show features on scales approximately 6 feet-15 feet, corresponding to masses approximately $5\text{--}80 \times 10^{14}$ solar mass at the surface of last scattering, which are likely to be the seeds of clusters of galaxies. The power spectrum estimates have a resolution Δl approximately 200 and are consistent with earlier results in the multipole range l approximately less than 1000. The power spectrum is detected with high signal-to-noise ratio in the range 300 approximately less than l approximately less than 1700. For 1700 approximately less than l approximately less than 3000 the observations are consistent with the results from more sensitive CBI deep-field observations. The results agree with the extrapolation of cosmological models fitted to observations at lower l , and show the predicted drop at high l (the "damping tail").

Author

Anisotropy; Astronomical Models; Background Radiation; Cosmic Microwave Background Radiation; Mosaics; Cosmology

20020068100 NASA Marshall Space Flight Center, Huntsville, AL USA

Soft X-Ray Emissions from Planets and Moons

Bhardwaj, A., Indian Space Research Organization, India; Gladstone, G. R., Southwest Research Inst., USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Waite, J. H., Jr., Michigan Univ., USA; Grodent, D., Liege Univ., Belgium; Lewis, W. S., Southwest Research Inst., USA; Crary, F. J., Michigan Univ., USA; Weisskopf, M. C., NASA Marshall Space Flight Center, USA; Howell, R. R., Wyoming Univ., USA; Johnson, R. E., Virginia Univ., USA; [2002]; 2p; In English; ESLAB 36 Earth-like Planets and Moons, 3-8 Jun. 2002, Noordwijk, Netherlands; Sponsored by Electronic Service Lab. s.r.l., Italy; No Copyright; Avail: Issuing Activity; Abstract Only

The soft x-ray energy band (less than 4 keV) is an important spectral regime for planetary remote sensing, as a wide variety of solar system objects are now known to shine at these wavelengths. These include Earth, Jupiter, comets, moons, Venus, and the Sun. Earth and Jupiter, as magnetic planets, are observed to emanate strong x-ray emissions from their auroral (polar) regions, thus providing vital information on the nature of precipitating particles and their energization processes in planetary magnetospheres. X rays from low latitudes have also been observed on these planets, resulting largely from atmospheric scattering and fluorescence of solar x-rays. Cometary x-rays are now a well established phenomena, more than a dozen comets have been observed at soft x-ray energies, with the accepted production mechanism being charge-exchange between heavy solar wind ions and cometary neutrals. Also, Lunar x-rays have been observed and are thought to be produced by scattering and fluorescence of solar x-rays from the Moon's surface. With the advent of sophisticated x-ray observatories, e.g., Chandra and XMM-Newton, the field of planetary x-ray astronomy is advancing at a much faster pace. The Chandra X-ray Observatory (CXO) has recently captured soft x-rays from Venus. Venusian x-rays are most likely produced through fluorescence of solar x-rays by C and O atoms in the upper atmosphere. Very recently, using CXO we have discovered soft x-rays from the moons of Jupiter-Io, Europa, and probably Ganymede. The plausible source of the x-rays from the Galilean satellites is bombardment of their surfaces by energetic (greater than 10 KeV) ions from the inner magnetosphere of Jupiter. The Io plasma Torus (IPT) is also discovered by CXO to be a source of soft x-rays by CXO have revealed a mysterious pulsating (period approx. 45 minutes) x-ray hot spot is fixed in magnetic latitude and longitude and is magnetically connected to a region in the outer magnetosphere of Jupiter. These surprising results have called into question our understanding of Jovian auroral x-rays. In this paper, we will present a comparative view of the x-ray

observations on planets, comets, and moons, with emphasis on recent results from CXO, and discuss the proposed source mechanisms.

Author

Solar System; Solar X-Rays; X Ray Astronomy; Earth-Moon System; Comets

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Low-Energy Study of Gamma-Ray Bursts Using Two BATSE Spectroscopy Detectors

Pangia, Michael J., Georgia Coll. and State Univ., USA; Research Reports: 2001 NASA/ASEE Summer Faculty Fellowship Program; July 2002, pp. XLI-1 XLI-5; In English; Also announced as 20020068792; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Gamma-ray bursts (GRBs) are energetic, short-duration emissions of gamma-rays from astronomical sources typically well beyond our galaxy. The Burst and Transient Source Experiment (BATSE) that was onboard NASA's Compton Gamma-Ray Observatory (CGRO) had detected an unprecedented 2704 GRBs during CGRO's nine-year mission. BATSE consisted of eight detector assemblies located at the corners of CGRO to give full sky coverage. Each assembly consisted of two detectors, a Large Area Detector (LAD) and a Spectroscopy Detector (SD). In determining the detail features of GRBs, the degree to which they possess a low-energy component (approx. 10 keV) is of interest. Preece has developed a method to study the low-energy characteristics and concluded that 14% of the 86 bright GRBs they studied had a definite low-energy component, referred to as a low-energy excess. Their study, and the present study as well, needed to use SD data, because it extends down to the low-energy range when operating in a high-gain mode. For their study, low-energy data was used from just one SD. To better quantify the low-energy behavior, this study will consider bursts for which two SDs satisfy the same criteria as used by Preece. The procedure developed by Preece to study the low-energy aspects of GRBs with BATSE data is to fit the data to a representative spectral function. In particular, two components are used, one corresponding to the low-energy component, and another representing the main part of the spectrum. The low-energy function used is the optically thin thermal bremsstrahlung (OTTB) model.

Derived from text

Gamma Ray Astronomy; Gamma Ray Observatory; Gamma Ray Bursts; Gamma Ray Spectrometers

20020069120 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Simple Concept for Modeling Cosmic Ray Modulation in the Inner Heliosphere During Solar Cycles 20-23

Richardson, I. G., NASA Goddard Space Flight Center, USA; Wibberenz, G., Kiel Univ., Germany; Cane, H. V., NASA Goddard Space Flight Center, USA; April 2002; 52p; In English

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Recent observations suggest a close relationship between the evolution of the solar magnetic field and high energy cosmic ray modulations at 1 AU on time-scales of approximately greater than or equal to 1 year. We investigate this relationship using the simple concept that changes in the solar magnetic field propagate from the Sun and cause a change in the radial diffusion coefficient, assumed to scale as some inverse power of the IMF magnitude (K (proportional to) $B(\text{sup } -n)$). Increases in the interplanetary magnetic field (IMF) cause a reduction in the cosmic ray density in the inner heliosphere. A continuous recovery process is also assumed to operate, represented by a time scale τ which physically is related to particle entry into the depleted regions of the heliosphere by drift and diffusion processes. We integrate numerically the spherically symmetric equation representing this process, and incorporate the observed variations of the parameters included in the equation. The concept is able to account for the variations in cosmic ray intensity at 1 AU during solar cycles 20-23 remarkably successfully using physically plausible values of n is approximately 1 - 2. An important requirement is that recovery times are shorter (τ is approximately 30 days for greater than 2 GV cosmic rays observed by neutron monitors) during epochs when the polarity of the solar global magnetic field A is greater than 0, than when A is less than 0 (τ is approximately 100 days). This dependence has a simple physical interpretation, since particle inflows into the inner heliosphere are expected to be faster from over the poles in A is greater than 0 epochs than along the heliospheric current sheet when A is less than 0. We also identify a period around solar maximum when recovery times are long, consistent with the disappearance of latitudinal intensity gradients observed by Ulysses approaching the maximum of solar cycle 23. This period commences when the axisymmetric component of the solar open flux reaches a minimum, essentially corresponding to the disappearance of the polar coronal holes, prior to solar maximum. Part of the energy-dependence of the size of cosmic ray intensity variations can be accounted for by recovery times that decrease with increasing particle energy. Despite the simplicity of the concept, we suggest that it provides important insight into the relationships between variations of the solar magnetic field, interplanetary parameters, and cosmic ray modulation.

Author

Cosmic Rays; Heliosphere; Solar Cycles; Solar Magnetic Field; Periodic Variations

20020069126 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA

FIP, FIT or MAD? Analysis of High Signal-to-Noise ASCA Spectra of Coronal Stars *Final Report, 15 Feb. 1999 - 14 Feb. 2002*

Simon, Theodore, Hawaii Univ., USA; [2002]; 11p; In English

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ASCA (Advanced Satellite for Cosmology and Astrophysics) and EUVE (Extreme Ultraviolet Explorer) spectra of active late-type stars imply that Fe and other medium-Z elements may be 2-10 times less abundant in the coronae of these stars than in their photo-spheres (the MAD effect). These deficiencies may be related to the solar FIP (First Ionization Potential) effect, in which Fe and other low First Ionization Potential elements appear enriched in the solar corona over their photospheric values. The FIP effect is time variable. As part of this proposal, the K0-2 III star, 29 Draconis, was observed in X rays with the ASCA spacecraft in order to measure the coronal abundances of this star at three different stellar longitudes over its 31-day rotation cycle. The goal of the observations was to learn whether coronal abundances, and hence coronal magnetic structure, vary across the surface of 29 Draconis in phase with the motion of dark star-spots across its disk. A second task included in this project was a systematic reanalysis of 18-20 deep exposures of active coronal stars, which were extracted from the ASCA public archives. New thermal models were computed for each spectrum in order to derive coronal metal abundances for each star. The goal of this survey was to search for possible trends in coronal abundance with various stellar parameters such as rotation, chromospheric activity levels at ultraviolet and optical wavelengths, or evolutionary stage.

Author

X Ray Astronomy; Stellar Coronas; Stellar Spectra; Magnetic Field Configurations; Starspots

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20020070665 NASA Ames Research Center, Moffett Field, CA USA

Computing, Information and Communications Technology (CICT) Website

Hardman, John, NASA Ames Research Center, USA; May 29, 2002; 20p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Computing, Information and Communications Technology Program (CICT) was established in 2001 to ensure NASA's Continuing leadership in emerging technologies. It is a coordinated, Agency-wide effort to develop and deploy key enabling technologies for a broad range of mission-critical tasks. The NASA CICT program is designed to address Agency-specific computing, information, and communications technology requirements beyond the projected capabilities of commercially available solutions. The areas of technical focus have been chosen for their impact on NASA's missions, their national importance, and the technical challenge they provide to the Program. In order to meet its objectives, the CICT Program is organized into the following four technology focused projects: 1) Computing, Networking and Information Systems (CNIS); 2) Intelligent Systems (IS); 3) Space Communications (SC); 4) Information Technology Strategic Research (ITSR).

Derived from text

Computers; Information Systems; Websites; Communication

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